The Effect of Professional Development

on Teachers' Technology Use in a Rural Setting

by

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Abstract

Various factors affect and are affected by school environment. These include rural geographic location, school leaders' actions, community involvement, and teacher quality. Teacher quality is a significant factor which contributes to student outcomes. Teacher quality can hinder or enhance levels of student achievement. This dissertation examined various factors affecting teacher quality and focused on effective teacher development to enhance this major contributor to overall school environment and student outcomes in a rural setting. A technology intervention focused on teacher development in terms of teachers' efficacy in their abilities to provide effective technology integration for instructional purposes was implemented. A mixed methods study was conducted to determine whether the implemented intervention would result in a change in teachers' technology efficacy and/or their beliefs in the benefits of technology integration for instructional purposes. The study site was a rural school in a south eastern state. Fortyeight teachers participated in relevant and consistent technology professional development during the spring semester of the 2017-2018 academic year.

Keywords: school environment, teacher quality, teacher development, teacher efficacy, professional development, rural schools, technology integration

Dissertation Adviser: Dr. Karen Karp

Dedication

This dissertation is dedicated to my daughters, Jasmine and Jade-Ann. To Jasmine for her resilience, encouragement, and endless support. Jazzy always believed in me and was a constant motivation for me to finish strong. To Jade-Ann for her always happy countenance, endless smiles, and boundless energy! Jade doubled my motivation, resilience, and spirit to persevere.

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Chapter 1 Self-efficacy and Technology Integration

Over the years, changes in society have resulted in changes in educational demands, especially in terms of the role of educational technology in teaching and learning (Ertmer & Ottenbreit-Leftwich, 2010; Koehler & Mishra, 2009). While some schools have readily adapted to this 21st century need of society, there are other schools that are yet to significantly do so. Specifically, schools in rural areas are at a disadvantage (Rakes, Fields, & Cox, 2006). In general, children who attend rural schools, often do not have the same levels of access to experiences and resources as children who live in suburban and some urban regions (Rakes et al., 2006; Sundeen & Sundeen, 2013). The effective use of technology is a skill necessary to fulfill job requirements and support everyday living in the 21st century. As such, this demand includes the need for effective technology integration in the processes of teaching and learning; however, the varying degrees of technology infusion among schools is quite significant (Davies & West, 2014; Ertmer & Ottenbreit-Leftwich, 2010; Moersch, 1995). In comparison to non-rural schools, rural schools have integrated technology use to a lesser extent, often due to a lack of infrastructure and resources (Bauch, 2001; Howley & Howley, 1995).

Statement of the Problem

Nearly one in every four American children is educated in a rural school setting (Ayers, 2011; Azano, Callahan, Missett, & Brunner, 2014; Johnson & Strange, 2009; Strange, Johnson, Showalter, & Klein, 2012; Sundeen & Sundeen, 2013). The quality of education that rural students receive should be adequate and up to par with that of their counterparts in other geographic areas. Students in rural settings, however, face numerous inequalities (Bauch, 2001; Brownell, Bishop, & Sindelar, 2005; Lowe, 2006; Roscigno, Tomaskovic-Devey, & Crowley, 2006; Sundeen & Sundeen, 2013). Rural school location results in unique regional, school, teacher, and student characteristics which pose challenges to the rural educational system. These include rural geographic location and socioeconomic struggles (Brownell et al., 2005), student diversity issues (Reed, 2010; Yeo, 1999), technology access (Sundeen & Sundeen, 2013), effective computer use in the classrooms (Beeson & Strange, 2003), as well as the difficult task of staffing rural schools with highly qualified teachers (Lowe, 2006; Rakes et al., 2006). Nevertheless, rural schools are capable of enhancing education through technology integration to enhance teaching and learning (Bauch, 2001) and creating a school environment which fosters actions and attitudes geared towards high levels of student performance (MacNeil, Prater, & Busch, 2009). In creating this environment, rural schools help to ensure that the educational experiences address the demands and standards of the 21st century technologically driven society.

Technology has changed the demands for human skills in the world (Levy, 2010). Today's students exist in a technology-dependent environment, which requires critical thinking (Rauen, 2001; Saavedra & Opfer, 2012). Like schools in other regions, rural schools must acknowledge this shift and prepare rural students accordingly. At the heart of this shift is the fact that technology resources, such as computers and other such devices, have changed and continue to change. Desired twenty-first century skill sets emphasize student proficiency in independent thinking, decision making, and problem solving (Silva, 2009) often using technology. The state of interconnectivity which exists within our global economy and ecosystem, and throughout our political channels dictates that students must learn how to effectively communicate, collaborate, and problem solve with individuals worldwide (Saavedra & Opfer, 2012). To prepare students, schools need to identify the demands of a digital age and offer an education which emphasizes relevant goals and realities.

The purpose of schools is to prepare students for quality lives in their communities and societies – while they are in school and beyond school years (Reimers, 2009); simply being educated in a rural area should not deny rural students the opportunity for a rich and meaningful 21st century, technology-integrated educational experience. North Central Regional Educational Laboratory (NCREL) research indicates that poor, small, rural schools are capable of doing well (D'amico, 2000; MacNeil et al., 2009). D'amico (2000) presents first-year results of NCREL's study of four successful rural Midwestern schools. The study set out to identify the extent to which the rural schools were "ahead of the curve" regarding the implementation of innovative improvement initiatives. Located in southern Ohio, central Iowa, and northwest Michigan, the schools studied included one high school, one elementary school, one K-12 school, and one school serving pre-K-2. Each of the four schools reflected outstanding educational initiatives it had successfully implemented; within their initiatives all the schools incorporated high end technology and used a mix of conventional and non-conventional testing strategies. In addition, the four schools implemented unique staff recruitment and retention mechanisms, created opportunities to help staff members learn leadership skills, applied novel approaches to resource acquisition, management, and allocation, as well as, built programs and organizational support systems which result in equitable educational opportunities for all students (D'amico, 2000). The researchers visited each of the study sites on multiple occasions conducting interviews and observations. Individuals interviewed included teachers, administrators, parents, students, and community members. The researchers observed faculty meetings, classroom interactions, and planning sessions for evaluating the implementation of chosen initiatives. Finally, data collection also extended to the researchers reviewing meeting notes, curriculum materials, student products, and grant proposals for the initiatives in place. Findings of the study note that there were various elements of success common to all four rural schools. For example, all the schools reflected school cultures amenable to change and experimentation and emphasized investment in continuous improvement, self-analysis, reflection, attention to principles of change, local adaptation of policies, and dedication to solid research.

Despite the various aforementioned challenges, rural schools must and can meet the responsibility of producing graduates who can effectively function in the 21st century technology-driven society. As the research reflects, there are various needs which rural schools can fulfill in efforts to provide students with an adequate educational experience comparable to that of their peers in other geographical regions. Among these needs are access to various technologies, programs to address the gap created by students' socioeconomic struggles, and high quality teachers, just to name a few. This research explores how investing in professional development can affect teacher quality, specifically in terms of teachers using technology for instructional purposes.

Purpose of the Study

A key contributor to a positive rural school environment and high student achievement is teacher quality and effective classroom instruction. The purpose of this study is to succinctly explore the relationship among these factors, specifically highlighting the significance of teacher quality on overall school environment and student outcomes, as well as, determining a meaningful way to improve teacher quality in a rural setting. Although student characteristics contribute to student outcomes (Coleman et al., 1966; Tuttle et al., 2010), research indicates that teacher quality is the critical variable when it comes to influences on student achievement (Rivkin, Hanushek, & Klein, 2005; Robinson, 2008). In fact, Coleman et al. assert that the teacher is actually the most influential school factor affecting student achievement outcomes

(1966). As such, school leaders must make efforts to connect rural teachers with the professional development and training they need in order to ensure that they practice habits of effective teaching as opposed to promoting a pedagogy of poverty (Haberman, 2010).

In discussing teacher practices, Haberman (2010) challenges educators to think differently and to approach classroom instruction in a manner which is not built on a pedagogy of poverty, that is, not solely dependent on teachers' being in absolute authority, constant teacher direction, and students simply being compliant. Haberman (2010) identifies twelve characteristics of good teaching. These characteristics include students involved in issues of critical concern, students involved with explanations of human differences, students assisted in viewing and understanding major ideas and principles, as well as students involved in planning their educational studies. Haberman (2010) further notes that when students are involved in applying justice, fairness, or equity to their world, when they are actively involved in their learning, and when they are directly involved in real-life experiences and heterogeneous groups, then good teaching is taking place. Haberman (2010) urges educators to have students think about ideas which question common sense or widely accepted assumptions, involve students in revising their work, involve students in reflecting on their own lives, and involve them with the technology of information access. According to Haberman (2010), when these characteristics are met, it is likely that good teaching is going on. To be successful, rural teachers must be knowledgeable of and carry out best policies and practices in teaching 21st century skills (Darling-Hammond & Richardson, 2009; Voogt, Erstad, Dede, & Mishra, 2013). As noted, Haberman (2010) specifically highlights that good teaching involves students being involved in using technology to access information.

Successfully involving rural students in the technology of information access requires rural teachers to be familiar with and comfortable using educational technology. The 21st century needs teachers with strong content and pedagogical knowledge but who can also effectively integrate technology for instructional purposes (Koehler & Mishra, 2009; Mishra & Koehler, 2006). The content knowledge and instructional expertise (pedagogical knowledge) of teachers greatly contribute to effective teaching and learning which students experience (DarlingHammond, 2000a; Garet et al., 2001). Traditionally, these two areas (content and pedagogy) have been the focus of teacher preparation, development, and quality. However, because technology is changing human interactions (Koehler et al., 2011; Levy, 2010), there is the necessity for teacher training in the effective use of technology in instruction (Paraskeva, Bouta, & Papagianni, 2008). Computer literacy which moves beyond the basics of word processing is a critical need (Haberman, 2010).

Conceptual Framework

School culture refers to the values and norms of a school, while climate refers to behavior (MacNeil et al., 2009). Both culture and climate affect school environment on a whole. However, school climate and culture themselves are also affected by several factors (Bouck, 2004). These factors include community members and other outside stakeholders being involved with the school (Kushman & Barnhardt, 2001), school leaders' actions (Bennis & Nanus, 1985; Lowe, 2006), and the rural geographic location of a school (Bauch, 2001; Bouck, 2004; Howley & Howley, 1995; Irvin, Meece, Byun, Farmer & Hutchinson, 2011). Each of these factors are capable of positively or negatively affecting school environment. School environment (climate and culture) also helps to determine school leaders' actions and the level of community involvement in school experiences. School leaders' actions and the relationships between schools and their surrounding communities can influence school functions and student achievement, factors which in turn affect the communities where rural schools are situated.

Geographic location is a significant factor which directly impacts school environment. In particular, the geographic location of rural schools often put them at a disadvantage in terms of accessing relevant educational resources (Bouck, 2004; MacNeil et al., 2009, Schwartzbeck et al., 2003; Unruh & Holt, 2010). Rural schools often struggle to attract teachers and fill vacant positions resulting from teacher shortages (Bouck, 2004; Schwartzbeck et al., 2003). Rural schools often resort to employing teacher candidates from alternative certification programs (Unruh & Holt, 2010), and hiring through alternate avenues yields varying results for teacher quality (Darling-Hammond, 2000a; Kee, 2012).

Teacher quality is a significant factor which contributes to student outcomes (Coleman et al., 1966; Lareau, 2011).-When exploring teacher quality two significant factors must be considered: teacher knowledge (Darling-Hammond, 2000a; Garet et al., 2001) and teacher beliefs (Woolfolk Hoy, Hoy, & Davis, 2009: Rubie-Davies, Flint, & McDonald, 2011). What teachers know and what they believe contribute to teachers' thoughts and decisions. Traditionally, educators have focused on teacher quality in terms of teachers' content and pedagogical knowledge; however, 21st century shifts in technological demands and functions has resulted in the significance of teachers developing technology knowledge (Koehler & Mishra, 2009). It is also equally important for teachers to understand the interactions among the three types of knowledge and apply technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2009; Mishra & Koehler, 2006) in the teaching and learning opportunities they facilitate.

Similar to teacher knowledge, teacher beliefs play a role in determining teacher quality because what teachers believe about education and their own capabilities is likely to influence their thoughts decision making. This dissertation study particularly focuses on teachers' beliefs regarding their own capabilities; teacher efficacy directly impacts teacher quality (Bandura, 1977; 2014; Sundeen & Sundeen, 2013; Young, 1998). If teachers do not believe that they are capable of carrying out certain actions well, they are not likely to attempt them, even when evidence demonstrates their positive influence on student outcomes. This is true with technology integration; if teachers do not believe that they are capable of effectively using technology for instructional purposes, they are not likely to do so (Paraskeva et al., 2008). Extant literature provides evidence that teacher knowledge and beliefs contributes to teacher quality and teachers' actions including relationships with students (Kiefer, Ellerbrock, & Alley, 2014) and implementation of instructional strategies.

A supportive school environment also contributes to teacher quality (Barley & Beesley, 2007; Kraft & Papay, 2014; MacNeil et al., 2009). That is, a school environment which provides teachers with adequate guidance, avenues for instructional improvement and overall support, including providing teachers with relevant and adequate opportunities to expand their knowledge (Kraft & Papay, 2014) can, and ultimately affects teacher actions. With an interest in teacher quality, this research seeks to explore how this contributing factor to school environment (climate and culture) can be enhanced, particularly in relation to teacher development relating to rural teachers' effective technology use for instructional purposes. Figure 1 illustrates the relationships among these factors. In addition, each factor included in this framework is described in this chapter.

Figure 1 Conceptual Framework

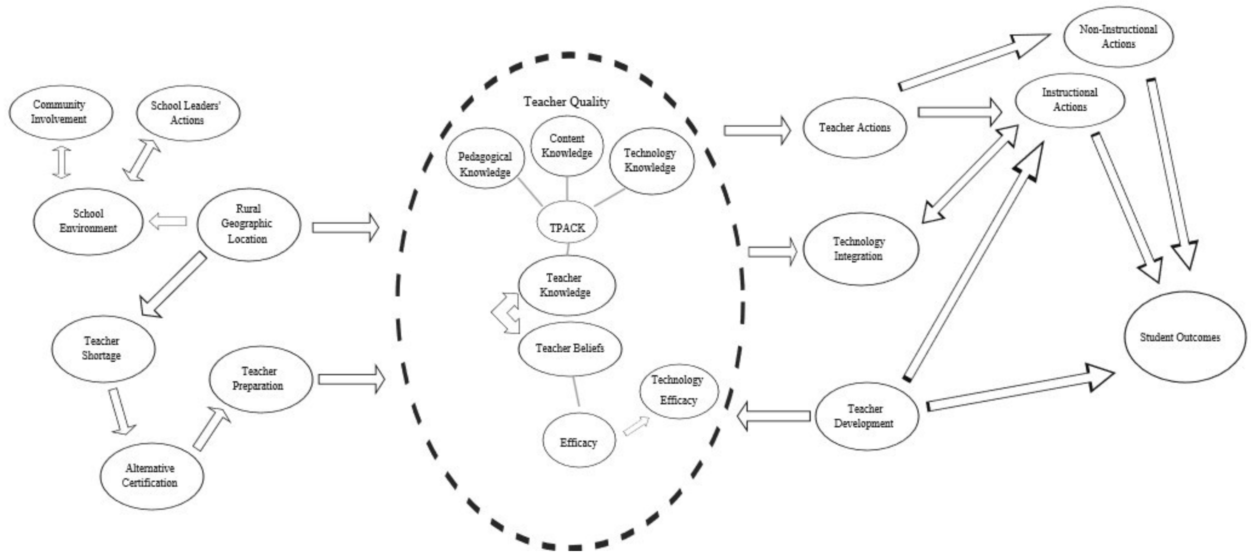

Figure 1. Conceptual framework illustrating the various factors which affect school environment. The figure reads from left to right and identifies significant reciprocal and single direction relationships among the factors outlined.

Theoretical Framework

The 21st century workforce requires employees to think differently, act differently, and use different tools, and their education must change in order to address their changed needs. In other words, the educational approach used to teach these individuals must effectively incorporate the use of technology and recognize and address the digital changes which have occurred in the global environment and subsequently in 21st century learners. Rural students' educational experiences should prepare them for school success and life beyond school in a digital world. As such, their learning activities and overall school experiences should be reflective of the learner-centered approach to education highlighted by Haberman's (2010) assertions regarding good teaching. A learner-centered approach is also further facilitated by the highest levels of technology implementation outlined by both the SAMR model (Puentedura, 2010) and the LoTi framework (Moersch, 1995; 2010). Haberman (2010), Puentedura (2010) and Moersch (2010) each recognize and outline the need for teachers' instructional approaches to be engaging, authentic, and learner-centered while, requiring the use of higher-order thinking skills and digital tools and resources. However, teachers are unable to meet these demands if they do not have the necessary technology knowledge or self-efficacy.

Technology enhanced instruction is a realistic way for teachers to fulfill the responsibility of adequately preparing students for success in today's world (Looi et al., 2008; Rakes et al., 2006). However, this approach to teaching and learning is impeded if teachers are not comfortable using technology or if they believe that they cannot effectively integrate technology in lessons. Individuals who do not consider themselves competent are less likely to use technology tools (Moersch, 1995; Paraskeva et al., 2008). Self-efficacy contributes to teachers' technology use (Paraskeva et al., 2006), and the theory of self-efficacy suggests that teachers will often choose a level of innovation that they believe they can manage, which may not be the most effective or the best option (Moersch, 1995) to facilitate or enhance teaching and learning with technology implementation.

The theory behind self-efficacy is founded in social cognitive theory (Henson, 2001); triadic reciprocal causation suggests future behavior as a result of environmental influences, individual behavior, and internal personal factors. Bandura (1977) defines self-efficacy as beliefs in one's ability to organize and carry out courses of action necessary to produce given attainments. Instructional strategies teachers use in their classrooms are due, in part, to their perceptions of their own self-efficacy (Moersch, 1995; Vannatta & Nancy, 2004). In other words, teachers' beliefs in their abilities play a role in their approaches to the teaching and learning which take place in their classrooms. Self-efficacy theory and empirical evidence supports the argument that teachers do not implement new and effective strategies even with evidence in support of these approaches.

The self-efficacy of teachers is a factor which directly contributes to their abilities to effectively integrate technology in their lessons (Paraskeva et al., 2008; Young, 1998). Bandura reasoned that an individual is motivated by two forces: outcome expectations and efficacy expectations (Bandura, 1977; Bandura, Adams, & Beyer, 1977; Young, 1998). Outcome expectations relate to a person's belief that his or her behavior will lead to a particular outcome, while efficacy expectations relate to a person's conviction that he or she can actually carry out the behavior which will lead to the particular outcome (Bandura, 1977). The expectations and standards held by individuals, in this case teachers, regarding technology integration, directly impact school environment and student outcomes (Paraskeva et al., 2008; Young, 1998).

This research focuses on the effectiveness of teachers' instructional actions as affected by their knowledge regarding technology implementation. Teachers' knowledge and perceptions of their abilities to accomplish these tasks affect their actions (Moersch, 1995; Paraskeva et al., 2008). Their self-efficacy helps to determine the instructional strategies they choose to employ or not to employ (Moersch, 1995; Vannatta & Nancy, 2004). Exploring this concept is important because it can be argued that if teachers fail to employ certain instructional approaches, student outcomes could suffer (Holden & Rada, 2011).

Teachers who reflect positive attitudes and perceptions, in addition to high rates of selfconfidence regarding technology use may be more likely to use technology for instructional purposes (Holden & Rada, 2011). The Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989) represents how users come to accept and use a certain technology; this model is applicable to teachers' use of educational technologies. Holden and Rada (2011) extend the TAM to incorporate teachers' perceived usability and self-efficacy measures regarding technology they were currently using. According to the researchers, TSE and CSE are the same except TSE focuses on the ability of teachers to perform tasks on specific technologies they individually identified rather than on computers in general (Holden & Rada, 2011). They administered a three-part survey to 99 K-12 teachers to collect information on demographics, computer self-efficacy (CSE), and technologies currently used. The third section of the survey required teachers to select a currently used technology and provide responses regarding perceived usefulness and ease of use, attitude toward using, and technology-specific general selfefficacy toward the identified technology. The researchers noted that TSE and CSE are the same, except that TSE focuses on the ability to perform tasks on the participant-identified technology, rather than computers in general (Holden & Rada, 2011). Study findings revealed that teachers' technology self-efficacy (TSE) was more beneficial to the TAM than their computer selfefficacy; that is, teachers' technology self-efficacy had a higher influence on their technology use than their computer self-efficacy. Analyzing Pearson's correlations, Holden and Rada (2011) found that the relationship between TSE and perceived ease of use (PEU) was significantly stronger than the relationship between CSE and PEU. Likewise, the relationship between TSE and perceived ease of use and usability (PEUU) was also significantly stronger.

Supporting teachers in effective technology integration requires that they engage in authentic learning experiences to acquire the critical technological pedagogical content knowledge to enhance teaching and students' learning. The theory of constructivism asserts that individuals, in this case teachers, create meaning based on their own experiences (Ertmer & Newby, 2013; Piaget, 1970). As such, teachers must participate in technology integration experiences geared toward helping them to build personal experiences and interactions regarding effective technology use for instructional purposes. There is a need for teachers to develop knowledge of technology integration in contexts which are relevant to them and their practices.

In other words, if teachers are to effectively construct their own knowledge regarding technology integration, they must do so through their own authentic and reflective experiences of technology integration. Teachers have the opportunity to experience authentic and reflective experiences of technology integration when they engage in activities, for example professional development, which require them to learn about technology tools and resources and apply this knowledge to the actual use of these resources to facilitate effective instruction in their classrooms. Through these practical experiences, teachers have the opportunity to develop knowledge of useful technology integration in a context that is relevant to them.

Review of Literature

This section discusses significant factors which contribute to school environment including climate and culture, rural geographic location, community involvement, school leaders' actions, teacher preparation, teacher quality, teacher actions, teacher efficacy, teachers' technology self-efficacy, and technology integration in instruction. Each of these factors is addressed.

School Environment

The size of schools and their locations influence many areas of education, including the curriculum offered, and students' post-school outcomes (Bouck, 2004). For instance, smaller populations affect the number and variety of courses offered and how many different courses rural teachers instruct at the same time (Irvin et al., 2011). For the purpose of this study, school environment focuses on the climate and culture of a school, as influenced by various factors including community involvement, school leaders' actions, and rural geographic location.

School culture involves the values and norms of the school, while climate refers to behavior (MacNeil et al., 2009). If culture is not supportive of learning then student achievement can suffer (Watson, 2001). The positive culture of a school reflects the extent to which the school environment is characterized by respect, openness, mutual trust, and commitment to student achievement (Kraft & Papay, 2014). According to Freiberg and Stein (1999) climate is the heart and soul of a school and the essence of the school that attracts teachers and students to love it and desire to be a part of it. Various factors contribute to the culture and climate developed in a rural school; these include community involvement, school leaders' actions, and teacher quality.

Healthy school environments lead to higher student achievement (Barley & Beesley, 2007; MacNeil et al., 2009). However, a healthy school environment does not necessarily mean a school environment where there are no difficulties, such as a shortage in resources. Healthy school environments may exist even while schools struggle to meet various challenges and resolve difficulties, such as those which rural schools face. In a 2007 study, Barley and Beesley explored the success of 29 high-performing, high-needs (HPHN) rural schools. Each school in the study boasted distinguished assessment scores while having high percentages of free and/or reduced lunch rates indicating that the schools were high-performing but also high-needs. The researchers found that though the schools studied differed in context, they shared common characteristics: high rates of teacher retention, high expectations for students, and supportive relationships with their communities (Barley & Beesley, 2007).

Barley and Beesley (2007) also outlined top factors for rural school success as noted by the rural principals involved in the study. The factors include: high expectations for all students, structural supports for learning, teachers' effective use of student data, alignment of curriculum, instruction, and assessment, individualization of instruction for students, teacher retention, and ongoing, continual, research-based professional development for teachers.

In a 2009 study, MacNeil et al. reiterated the importance of a healthy school culture and climate. They compared suburban schools with similar schools in other geographic areas on their school climate. Researchers categorized the schools based on their location and students' academic achievement. The categories included Exemplary schools, Recognized schools, and Acceptable schools as measured by the State of Texas Accountability Rating System. The three categories of schools were then compared on the Organizational Health Inventory (OHI). This inventory consisted of 10 dimensions of school climate that address successful interaction among the members of an organization and the ability of the organization itself to handle stress from its environment (MacNeil, 2009). The inventory had 80 items (10 per dimension) on the same 5point Likert scale, and descriptive statistics and MANOVA were used to analyze the data. Findings from the 29 schools suggested that schools with healthy learning environments, that is, the more positive school climates and cultures, produced students who achieve higher scores on standardized tests. Researchers referenced test scores from more than 24,500 students (MacNeil et al., 2009). Each of the schools that had higher levels of student achievement as illustrated by their Exemplary rating, also reflected healthier climates than schools with Acceptable ratings. In fact, the Exemplary schools consistently reflected higher scores on each of the 10 dimensions (MacNeil et al., 2009). This research analysis also found that a key contributor to rural school success in the 29 schools included a community strongly invested and connected with the school.

Community involvement. When educators include their community in development and overall functioning of their schools, students gain numerous benefits. Kushman and Barnhardt (2001) report that rural communities involved in reform to enhance community and parent involvement in education prove effective, and benefits are further enhanced when educators reach out to the community. Covering seven case study sites, a subset of 42 rural communities and 11 different school districts, the researchers worked with school personnel and community members and referred to concept maps, document analysis, observations, surveys, and interviews for their data. The study sought to determine what factors promote school-community partnerships in rural settings, and how these partnerships are sustained over time. The researchers also documented benefits resulting from strong school and community partnerships, specifically increased academic success for students. Kushman and Barnhardt (2001) wanted to know what it takes for schools and communities to successfully work together toward achieving common goals for rural Alaska Native students. The findings provide evidence that increased positive parental and community involvement is particularly beneficial to rural school improvement in terms of the integration of culture and language, shared decision-making, parent/elder involvement in educating children, and partnership activities between schools and communities. The researchers assert that it is critical for educators and education reformers to acknowledge that education includes more than in-class knowledge and skills. (Kushman & Barnhardt, 2001).

School leaders' actions. Strong school leaders must understand that a high quality environment for teaching and learning is critical in terms of recruiting and retaining quality teachers (Lowe, 2006). As such, in addition to community involvement, the actions of school leaders affect and are affected by the climate and culture developed in a school. In addressing culture and climate, schools must provide the vision and leadership that will ensure an environment to cultivate excellent teaching and learning (Bennis & Nanus, 1985). No one is interested in being employed in a school district where the environment for teaching and learning is less than positive (Lowe, 2006), and it is in a school leader's power to create meaning and purpose at work (Short & Greer, 1997). While school leaders face great responsibility and high stakes accountability (Lowe, 2006), they can begin to create the school environments they desire through teacher development and shared leadership. School leaders must recognize that they are the ones who must ensure that teachers are empowered by their own efficacy (Short & Greer, 1997) and must also create a school environment that gives teachers the opportunity to develop such.

Developing a school vision helps stakeholders have a sense of what is important in their school's particular setting (Robbins & Alvy, 2009). Creating a positive school culture and climate requires school leaders to collaborate and communicate with stakeholders, including teachers; visions seen only by leaders are not enough to trigger an organized movement or effective change (Fullan, 2007). Furthermore, in order to create teacher investment, school leaders must collaborate and communicate, giving teachers a voice and involvement in opportunities to improve their own and their students' lives (Hughes, Hooper, & Amatea, 2009). As previously mentioned, research suggests that focusing on the development of school culture as a learning environment is vital to achieving improved teacher morale and increased student achievement (MacNeil et al., 2009). When an organization, in this instance a school, has a clear understanding of its purpose, why it exists and what it must do and who it should serve, then the culture will ensure that things work well. MacNeil et al., (2009) categorized such schools as having healthy environments. Positive and healthy school cultures which nurture and motivate teachers are likely to have greater success regarding student performance (MacNeil et al., 2009) because teacher quality is positively influenced. Like community involvement and school leaders' actions, the climate and culture of a school influences and is influenced by the quality of teachers employed.

Rural geographic location. The geographic location of a school affects various factors related to education (Irvin et al., 2011; Sundeen & Sundeen, 2013). Among the most common characteristics of rural settings that can affect education are small size, sparse settlement, narrow choices in the community (schools, shopping, and medical services), great distance from population concentrations (Monk, 2007), and lack of technology access (Sundeen & Sundeen, 2013). Sundeen and Sundeen (2013) highlight that while integrating instructional technology into all classrooms has the power to transform modern education and student learning, rural school districts do not have equal access to technology resources and often struggle to provide their schools with this needed technology. According to the researchers, decreased funding and other budgetary limitations directly impact technology access in several rural districts. Exploring the various types of instructional technology and their availability, Sundeen and Sundeen (2013) determine that in addition to Internet access, computers, document cameras, LCD projectors, and interactive whiteboards are available technologies with learning modalities that can improve student outcomes. The researchers suggest that rural school districts acquire necessary technology resources by identifying the most cost-effective resources, bidding in web-based auctions, and writing applicable teacher grants (Sundeen & Sundeen, 2013).

By attending rural schools, students are also challenged by many personal and educational hardships – from living in poverty to having less opportunity and sophistication in using technology (Beeson & Strange, 2003; Irving et al., 2011). In a 2003, Beeson and Strange conducted a descriptive analysis of the schools that serve the 21% of American students who attend school in rural communities with populations of less than 2,500. Data used in this report were gathered from the National Center for Education Statistics (NCES). According to the research, rural minority students and at-risk populations share several characteristics. The researchers also identify poverty as the greatest persistent challenge faced by education and highlights regions with the highest rates of rural child poverty. These regions include the

Southwest, the Appalachians, the Mississippi Delta, the Great Plains, and the Southeast. Beeson and Strange assert that while the scale of schools in rural America is small compared to urban schools, the number of students affected by rural school challenges are far too many to go unnoticed or unaddressed (2003). Forty-three percent of the nation's public schools are located in rural communities and account for 31% of the nation's school-aged children.

Inclusive of poverty, the characteristics of schools in geographically remote areas promote or hinder rural student success (Byun et al., 2012; Irvin et al., 2011; Rakes et al., 2006; Sundeen & Sundeen, 2013). In a 2011, Irvin et al. investigated whether high school characteristics and schooling experiences supported or constrained school achievement and the educational aspirations of rural students in high-poverty communities. The study sample included 6, 247 high school students from 64 high- and low-poverty rural communities. Data collected included student surveys on school adjustment and aspirations after high school and a teacher survey about participating students' school performance. Evidence suggested that school characteristics, for instance, lower student-teacher ratio, were favorable for achievement of rural youth in high-poverty communities. But smaller student populations often resulted in teachers teaching more than one course or more than one subject, leading to multiple preparations during a school day. In other words, with fewer students, teachers are forced to instruct multiple courses throughout the school day. Smaller student numbers limit teachers' abilities and opportunities to specialize as they are often required to meet a wider range of student needs (Monk, 2007). Expanded teaching loads and student responsibilities may act as a disincentive for high quality teachers to seek employment in rural areas. Additional findings from this study highlight that students in geographically isolated regions tend to have lower educational aspirations because they perceive that postsecondary education is unnecessary for local job opportunities (Bauch, 2001; Irving et al., 2011).

Similar research by Schaft, Alter, and Bridger (2006) suggests that attending school in a remote location supports higher academic achievement. Using interactional community theory to analyze the relationship between information technology and local development, Schaft et al. (2006) conducted a case study of an economically disadvantaged and geographically isolated rural school district. The researchers used a snowball sample and conducted semi-structured interviews with 21 key informants including community members and school officials to examine their perspectives on the introduction of advanced instructional technology within the school. Through these interviews, the researchers also explored the social and educational community development outcomes related to community access to high speed internet (Schaft et al., 2006). Other data included classroom observation field notes and a survey sent to 75 local organizations and businesses. Findings suggest that providing adequate access to a resource like technology facilitates educational improvement in rural schools. The school district's information technology initiatives positively contributed to educational improvement goals for students (Schaft et al., 2006). The researchers also noted that the investment in technology resulted in the strengthened communal bonds as well as the school district increasingly being recognized as a site which integrated cutting-edge information technology, with critical implications for instruction and educational improvement. Schaft et al. (2006) further assert that access to available technology resources may moderate the detrimental effects of school location and academic achievement for isolated rural schools. The researchers added that rural schools also need highly-qualified teachers but often experience significant teacher shortages.

Teacher shortages. A critical element of a healthy school environment includes highquality teachers to lead instruction. However, rural schools encounter serious challenges in recruiting and retaining these teachers (Barley & Beesley, 2007). In offering a variety of strategies to slow an increasing trend, Lowe (2006) argues that rural districts should approach teacher recruiting and retention as a top priority and integral component of the total school personnel system by implementing bold strategies aimed at attracting and retaining the best teachers. Examples of such strategies include considering a loan forgiveness plan for new teachers and providing housing for teachers.

Various factors contribute to a shortage of quality teachers in rural areas. According to Collins (1999), teachers primarily leave rural areas due to social, cultural, and professional isolation. Other factors include unattractive compensation (Rakes et al., 2006), fewer opportunities to specialize in teaching in one area (Monk, 2007) and the potential that teacher candidates do not know what most rural schools and communities can offer them in the way of an enjoyable lifestyle and a great place to work (Lowe, 2006; Osterholm, Horn, & Johnson, 2006). While Lowe (2006) suggests the use of incentives, Collins (1999) asserts that rural administrators should target teacher candidates with rural backgrounds, educational experiences, or personal characteristics who are already familiar with rural community experiences.

In efforts to create rural school environments which support student success, issues of teacher turnover and teacher shortages must be addressed because quality teachers must be in place in rural schools. Addressing issues of teacher turnover and shortages from an organizational perspective is likely to prove beneficial for student achievement (Ingersoll, 2001). Research indicates that teacher shortages are not a result of the number of qualified teachers (Ingersoll, 2001). On the other hand, evidence suggests that there are available teachers;

however, rural schools are not sufficiently attractive for these educators, and when these teachers do take jobs in these areas, rural schools do not do enough to encourage them to stay (Ingersoll, 2001). In fact, educational initiatives will not solve teacher shortage problems if organizational sources of low teacher retention are not addressed. However, rural schools also have a responsibility to enhance teaching and learning by taking actions to develop and nurture teachers who live in their own community.

In attempts to address the shortage of quality teachers, many school districts have the ability to grow their own teachers through active and dynamic future teacher clubs housed at their secondary schools (Lowe, 2006). Through these clubs, interested students are exposed to and prepared for roles as certified teachers through traditional teacher education programs. However, a more wide-spread response to school staffing challenges has come in the increase of the supply of teachers through a wide range of recruitment initiatives (Ingersoll, 2001). Policymakers in more than 40 states have implemented alternate routes to teacher certification, creating avenues into teaching other than the traditional option offered by 4-year undergraduate teacher education programs (Darling-Hammond, 2006; Ingersoll, 2001). Rural schools have benefitted from these programs because they help to address the teacher shortage problem; however, researchers have questioned which method of teacher education is best. While these debates are mostly ideological, growing research suggests that the kind of teacher education chosen (traditional route or alternative approaches) directly affects teacher quality (DarlingHammond, 2000a). If they lack rigor, alternative certification programs can negatively impact teacher preparation because teacher candidates are not likely to acquire the skills they need to perform as effective teachers. The needs of alternatively certified beginning teachers must be taken into consideration when they are first hired (Unruh & Holt, 2010); these individuals are often teaching while simultaneously learning how to teach. They have the potential to perform poorly simply because they do not feel completely prepared for the task at hand. However, alternative teacher certification programs are becoming increasingly popular as more and more teacher candidates opt out of the traditional route to earning teacher credentials. It is critical for alternative programs to be structured in an effective and rigorous manner in order to produce high quality teachers.

Alternative certification. The traditional route for teacher certification is for individuals to complete a four-year degree in education (Kee, 2012; Unruh & Holt, 2010). However, alternative certification programs which require less time commitment and offer a quicker path to the classroom have grown in popularity. In fact, a third of the new teachers being hired in recent decades have been prepared through an alternative program (Kee, 2012; National Research Council, 2010). Alternative programs were first introduced to help reduce teacher shortages (Unruh & Holt, 2010); however, solving the issue of teacher quantity does not automatically result in good teacher quality. Differences in training experiences between alternately certified and traditionally certified teacher programs could affect teachers' feelings of preparedness and their longevity in the teaching profession (Kee, 2012).

In a study of 1, 690 first-year teachers, Kee (2012) used data from the 2002-2003 Schools and Staffing Survey (SASS) to determine teachers' backgrounds and feelings of preparedness. Findings of this study indicated that alternatively certified teachers (n = 470) felt somewhat less well-prepared than traditionally certified teachers (n = 1,220). The study further noted that alternative program options which recruited teacher candidates and only provided abbreviated pre-service education but did not continue initial teacher education into the first year, produced beginning teachers who felt even less prepared than teachers in alternative programs which offered this first-year support (Kee, 2012). These findings indicate a need for schools to invest in their own teacher development. First-year teachers from traditional or alternate programs do not share similar experiences in terms of preparation. To fill teacher shortages, it is likely that rural schools will hire teachers certified by way of either program; providing adequate in-service development to equip teachers, regardless of training, with the relevant knowledge and skills to promote effective teaching and learning.

*Teacher preparation***.** The importance of having highly-qualified teachers has resulted in various discussions, criticisms, and on-going debates. Public dissatisfaction with public schools has included discontent with teacher education (Darling-Hammond, 2000a). The content knowledge, instructional expertise, and technology knowledge of teachers greatly contribute to the levels of self-efficacy teachers may possibly display and the levels of effective teaching and learning which take place in rural schools because teacher preparation affects teacher quality. Several factors contribute to teacher learning; these factors help to determine teachers' success or failure (Darling-Hammond & Richardson, 2009). Factors include teacher preparation and development, the design, depth, and sustainability of professional development, teachers' dispositions, and teachers' understanding of how students learn specific content. In today's society, teachers' ability to integrate content, pedagogical, and technology knowledge (Koehler & Mishra, 2009; Mishra & Koehler, 2006) is also critical.

Teacher preparation can help to develop teachers' abilities to examine teaching from the point of view of diverse learners who bring various experiences to the classroom (DarlingHammond, 2000a; Eppley, 2009). Diversity in the rural context is often related to socioeconomic status and student exceptionalities (Eppley, 2009). Many rural students are deeply rooted in their immediate communities, have extensive generational ties, and few opportunities to travel beyond their communities. Low socioeconomic backgrounds and various learning exceptionalities are evident in even small rural school populations (Bouck, 2004); teachers must act as effective mediators between the curriculum being taught and the actual experiences of their students (Eppley, 2009). That is, rural students face particular hardships, and they need teachers who are understanding. How teachers facilitate rural students' learning needs contributes to performance and achievement; it is imperative to provide schools with teachers who are technology savvy and can address the digital learning needs of the populations being served (Darling-Hammond, 2006; Darling-Hammond & Richardson, 2009). There is a need for teacher preparation programs to increase pedagogical attention, particularly focused on the challenges and rewards associated with teaching in rural environs (Eckert & Petrone, 2013). Increasing the use of technology provides an opportunity to invest in an instructional approach that educators can use to address teaching and learning for all students (Rakes et al., 2006). These opportunities are especially needed in the poor rural regions of the United States (Rakes et al., 2006). The researchers suggest that any tools that can contribute to the development of higher-order thinking skills in rural students, for example, computers should be considered critical for teachers to use in instruction. However, they also note that teacher beliefs regarding their personal abilities to effectively integrate technology, and their beliefs concerning the potential effect of technology on student achievement, are significant factors which greatly determine what actually takes place in a classroom (Rakes et al., 2006).

Dissatisfaction with teacher preparation has also come from within the profession as there have been calls to restructure the design of teacher education in efforts to strengthen its knowledge base, its connections between theory and practice, and its ability to support the development of strong teaching (Darling-Hammond, 2000a; Zeichner, 2010). Many teacher preparation programs struggle when it comes to providing teacher candidates with rural-based clinical experiences (Eckert & Petrone, 2013). Eckert and Petrone go on to say that a lack of meaningful related clinical experiences impact teachers' abilities to do well in rural environments.

In addition to rural-based clinical experiences, technology-based clinical experiences are also important for teacher candidates. Such experiences would help to ensure that new teachers gain knowledge and expertise in all three knowledge areas - content, pedagogy, and technology (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Participating in technology-based clinical experiences provide an opportunity for teachers to develop technology pedagogical content knowledge (TPACK) before actually becoming teachers who are expected to effectively put this knowledge into use. In efforts to prepare teacher candidates to integrate technology in their instruction, Dexter and Riedel (2003) suggest that schools, colleges, and departments of education develop and require coursework which afford students the opportunity to learn how to operate and teach with technology and requires them to demonstrate their technology integration abilities during student teaching. In this study, Dexter and Riedel (2003) surveyed 202 preservice teachers at the University of Minnesota six months after they completed their student teaching requirement. These students were participants in a teacher education technology project called Ed-U-Tech which required them to complete a 1.5 credit hour course in instructional technology. Using a 5point scale ranging from novice: not at all comfortable to expert: very comfortable, students were required to rate their skillfulness and comfort using educational technology in three separate situations: troubleshooting software and hardware problems, enhancing instruction, and completing other professional tasks. Survey data confirmed that setting expectations for designing and delivering instruction using technology was an effective influence for getting student teachers to use technology during their clinical experiences. However, study findings also report that low availability of technology at clinical experience sites hindered student teachers' use of technology for instructional purposes in actual classrooms

Teacher Quality

Teacher quality is affected by teacher preparation. For the most part, teachers' knowledge and beliefs dictate the levels of teaching and learning which take place in their classrooms. Because teachers interact with students on a daily basis, their knowledge and beliefs are influential factors which affect student outcomes.

Teacher knowledge. Teacher knowledge definitely contributes to the level of effective teaching and learning which is experienced in a school (Darling-Hammond, 2000a; Garet et al., 2001). As previously mentioned, three aspects of teacher knowledge must be considered: content knowledge, pedagogical knowledge, and technology knowledge (TPACK) (Koehler & Mishra, 2009; Mishra & Koehler, 2006). In terms of teacher preparation and development, content knowledge and pedagogical knowledge have been the focus of teacher quality in the past. However, the effect of technology changes on human interactions (Koehler et al., 2011; Levy, 2010) has resulted in a need for teachers to also become experts in technology knowledge. Additionally, teachers must also understand the interactions among the three aspects of teacher knowledge; they must develop technological pedagogical content knowledge (TPACK) knowledge (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

Technological pedagogical content knowledge. Teachers should understand how to apply technology knowledge in their respective content areas. According to the National Research Council (NRC, 1999) individuals (in this instance, teachers) understanding information technology enough to apply its use in a productive manner in their daily lives and at work, identifying when information technology can be used to enhance or hinder effort to complete tasks efficiently and productively, and being able to constantly adapt to changes in information technology is very important. Subsequently, content, pedagogy, technology, and the relationships among these three components are at the heart of successful teaching (Koehler & Mishra, 2009; Mishra & Koehler, 2006).

The TPACK model (Koehler & Mishra, 2009; Mishra & Koehler, 2006) provides an integrated framework reflective of required teacher knowledge for the effective integration of technology. This is an emergent form of knowledge which stems from an understanding of the subtle interactions among content, pedagogy, and technology knowledge. Figure 2 illustrates these interactions.

Figure 2 The TPACK Framework and its Knowledge Components

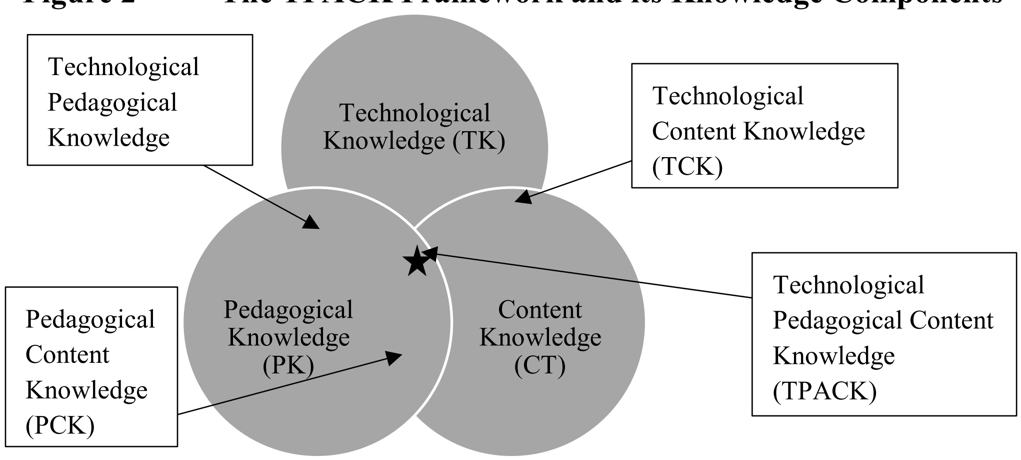

Figure 2. The TPACK framework illustrating each knowledge component and the overlapping relationships which teachers need to understand. The center of the figure is denoted by a star and identifies the significant interaction among all three types of knowledge.

Teachers should know more than the technical aspects of technology. On the other hand, it is important for them to comprehend technology's constraints and affordances when it comes to identifying relevant teaching approaches and representing content (Harris et al., 2009). In efforts to ensure that mathematics teachers understand these constraints and affordances and become more effect users of technology for instruction purposes, the Association of Mathematics Teacher Educators (AMTE) (2009) referred to the TPACK framework and the then current 2009 version of the National Educational Technology Standards for Teachers to design a technology guide for K-20 teachers and researchers to be able to monitor mathematics instruction at all levels. This useful application of TPACK (Koehler & Mishra, 2009; Mishra & Koehler, 2006) focuses on four areas of technology application, as shown in Table 1.

Table 1

AMTE'S Application of TPACK for K-20 Mathematics Instruction

Area	Guideline
I	Design and develop technology-enhanced mathematics learning environments.
II	Facilitate mathematics instruction with technology as an integrated tool.
III	Assess and evaluate technology-enriched mathematics teaching and learning.
IV	Engage in ongoing professional development to enhance technological pedagogical content knowledge.

Unfortunately, and despite increases in technology training, technology is still not being used by teachers to facilitate and support the most powerful approaches to instruction (Ertmer & Ottenbreit-Leftwich, 2010). Instead, technology is used in basic ways to sustain the existing curriculum rather than as a catalyst for changing and improving the ways that teachers and students learn (Moersch, 1995, 2010) or innovation. If the basic use of technology is to change, teachers need meaningful technology training and adequate technology support (Bradshaw, 1997).

Teachers' levels of technology use can be categorized and measured (Vannatta & Banister, 2009). According to Puentedura's SAMR model (2010), there are two clearly delineated categories of technology integration, enhancement and transformation. This delineation is illustrated by a single line in figure 1.3. Within these two categories, there are four ascending levels of technology incorporation. These levels include substitution and augmentation (enhancement) and modification and redefinition (transformation) (Puentedura, 2010). At the lowest level of substitution, technology is simply used as a direct tool substitute and there is no functional change in how technology is to be used to complete the task assigned. In augmentation, technology is again used as a direct tool substitute but with functional improvement in how technology is to be used to complete the task assigned. In modification, technology allows for significant changes in lesson design moving from mere substitution to innovative technology integration. The highest level of technology integration is redefinition in which technology facilitates the creation of new tasks which were previously inconceivable. Instructional approaches which consistently integrate technology at the highest levels are the most beneficial for student achievement (Puentedura, 2010). Figure 3 illustrates the delineation of the two categories and applicable levels of technology implementation according to the SAMR model.

Figure 3 **SAMR Model**

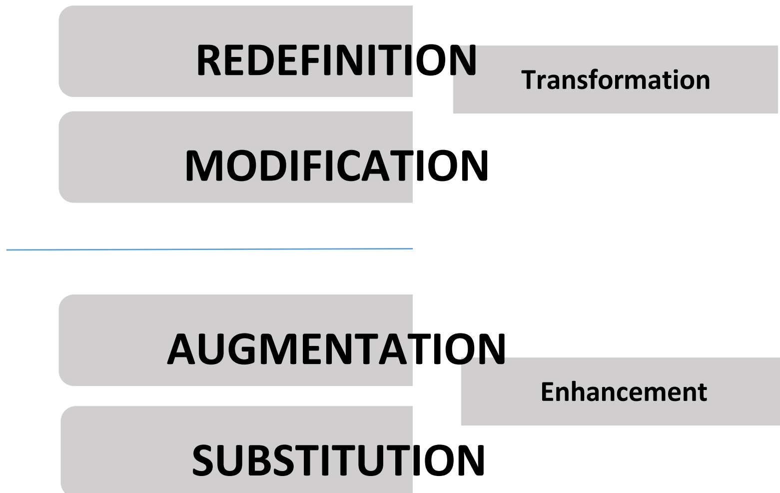

Figure 3. SAMR Model showing delineation between too categories of technology implementation and each level within the two categories.

Similar to Puentedura's (2010) SAMR model, is Moersch's (1995) levels of technology implementation (LoTi) framework, which has been more recently termed the levels of teaching innovation (LoTi) framework or H.E.A.T framework (Moersch, 2010), where H.E.A.T stands for higher-order thinking, engaged learning, authentic learning, and technology use (Moersch, 2010). Reflective of Haberman's (2010) characteristics of good teaching, the new Loti framework highlights attributes of the pedagogical continuum in terms of teachers' shift from a teacher-centered approach to a learner-centered approach, teachers' shift from lower levels of student cognition to higher levels, such as synthesis, problem solving, evaluation, and issues resolution (Moersch; 2010). The new framework also illustrates teachers' shift from classroom routines of research-based best practices to complex classroom routines, such as prompting student questions and generating hypotheses and teachers' shift from compliant use of digital tools and resources to more dynamic self-directed uses of technology resources (Moersch, 2010). While both versions (new and old) of the LoTi framework suggest the same levels of implementation which teachers possibly employ in their classroom, the newer version of the

LoTi framework places emphasis on “powerful teaching and learning as well as the use of digital tools and resources in the classroom” (Moersch, 2010, p.20).

The levels of teaching innovation range from non-use, which is level 0, to refinement, which is level 6. Table 2 illustrates technology use at each of Moersch’s levels of innovation. Level 0 or non-use, which is the lowest level of implementation where instructional focus may range from teachers’ direct instruction to collaborative, student-centered learning. However, technology tools and resources are not used. Level 1 or awareness is evident when the use of computers is only one step removed from the teacher. That is, computer-based applications have little relevance to individual teacher’s instruction program. Instruction emphasizes information dissemination to students using lectures of multimedia presentations created by teachers, Level 2 or exploration occurs when technology-based tools serve as a supplement to the existing educational program; the electronic technology is used as extension or enrichment to the instructional program. However, student learning and teacher questioning are focused on the lower levels of student cognitive processing. Technology implementation at Level 3 or infusion occurs when technology-based tools augment isolated instructional events. Students use digital tools and resources to complete tasks directed by teachers; higher levels of student cognitive processing are targeted. Level 4a or integration (mechanical) is evident when technology-based tools are integrated in manners that provide rich context for students’ understanding of applicable concepts, themes, and processes. Technology is recognized as a tool to identify and solve authentic problems relating to an overall theme/concept. This level involves students applying their learning to issues and experiences in the real world. Students use technology resources to investigate student-generated questions that inform content, process, and products included in the learning experience. Level 4b or integration (routine) is evident when students are completely engaged in exploring issues or the real world and solving authentic problems using digital tools and resources. Emphasis is placed on learner-centered strategies that foster personal goal setting, self-monitoring, student action, and issues resolution that call for higher levels of student cognitive processing. At Level 5 or expansion, technology access extends beyond the classroom. Teachers seek out technology applications and networking opportunities to expand student experiences. The sophistication and complexity of the digital resources and collaboration tools in the learning environment are supportive of the diversity, inventiveness, and spontaneity of teachers' experiential-based approach to teaching and learning. At the highest level of implementation, Level 6 or refinement, technology is considered as a process product and tool to assist students in solving authentic problems related to an identified real-world problem or issue. Students have ready access to a complete understanding of a vast array of technology-based tools. At this level, the instructional curriculum is entirely learner based, and "the pervasive use of, and access to, advanced digital tools and resources provides a seamless medium for information queries, creative problem solving, student reflection, and product development" (Moersch, 2010, p. 22).

According to Moersch (1995, 2010), a series of changes to instructional curriculum are observed as teachers move from one level to another. As previously mentioned, similar to the SAMR model and Haberman's characteristics of good teaching, the highest level of the new LoTi framework features a shift in instructional focus from an approach that is teacher-centered to one that is learner-centered (Moersch, 1995, 2010; Puentedura, 2010). However, providing instruction at the refinement or transformational levels of implementation is not likely to be automatic; teachers need training and support in order to implement technology at the highest levels (Bradshaw, 1997; Mishra & Koehler, 2006; Koehler & Mishra, 2009).

Table 2

Loti Framework – Levels of Teaching Innovation

Level	Category	Description
0	Non-use	A perceived lack of technologybased tools or a lack of time to pursue electronic technology implementation.
1	Awareness	The use of computers is one step removed from the teacher. Computer-based applications have little relevance to individual teacher's instructional program.
2	Exploration	Technology-based tools serve as a supplement to existing instructional program. The electronic technology is employed as extension or enrichment to the instructional program.
3	Infusion	Technology-based tools augment isolated instructional events.
4	Integration	Technology-based tools are integrated in a manner that provides a rich context for students'' understanding of pertinent concepts, themes, and processes. Technology is perceived as a tool to identify and solve authentic problems relating to an overall theme/concept.
5	Expansion	Technology access is extended beyond the classroom. Teachers elicit technology applications and networking to expand student experiences.
6	Refinement	Technology is perceived as a process product, and tool to help students solve authentic problems related to an identified real-world problem or issue. Students have ready access to a complete understanding of a vast array of technology-based tools.

Teacher beliefs. In addition to teacher knowledge, teacher beliefs also affect teacher quality. What teachers believe will influence their thoughts and instructional decisions (Woolfolk Hoy, Hoy, & Davis, 2009: Rubie-Davies, Flint, & McDonald, 2011). Rubie-Davies et al. (2011) explored relationships among teacher characteristics of teaching experience and gender, school contextual variables (socio-economic level of school and grade levels) and three sociopsychological variables (teacher expectations, teacher efficacy, and teacher goal reindentation). Participants in this study included 68 teachers from 18 schools in rural and urban locations. The teachers' years of teaching experience ranged from one year to 47 years. Teachers completed a questionnaire which gathered information related to teacher efficacy and goal orientation in reading. Teachers also completed a teacher expectation survey. Reading achievement data were collected for students. Rubie-Davies et al. (2011) found that teacher beliefs result in differences in teachers' instructional practices and differing classroom climates. Particularly, mastery-oriented beliefs predicted teacher efficacy for classroom management and student engagement. The researchers also assert that teacher efficacy in turn influences instructional strategies (Rubie et al., 2011). Teacher efficacy, what teachers perceive of their own capabilities, is a significant factor which contributes to teacher quality.

Teacher efficacy. Higher levels of perceived self-efficacy are likely to be accompanied by higher performance attainments in teachers (Bandura, 2014). Self-efficacy refers to an individual's belief in his or her ability to carry out a specific task (Bandura, 1977; Holden & Rada, 2011). Self-beliefs of efficacy affect human functioning through motivational and cognitive processes (Bandura, 1977; 2014). Teacher efficacy affects teacher quality and if teachers are good at the craft and can successfully carry out a task, for instance, using a particular instructional strategy, it is likely that they will do it well. However, the opposite is also true. If low quality teachers do not believe that they can effectively carry out a task, it is unlikely they will be successful and this holds true even for qualified teachers. In other words, teachers may perform poorly because they either do not have the ability or they have the ability but do not have the perceived self-efficacy to make the best use of their skills (Bandura, 1977; 2014). Teachers' beliefs greatly contribute to the teaching and learning which takes place in their classrooms (Sundeen & Sundeen, 2013; Young, 1998).

In determining factors which affect the effectiveness of a school, it is important to consider teachers' self-efficacy. Young (1998) argues that too often researchers focus on student achievement without considering the contribution of critical factors such as teacher efficacy. Young (1998) asserts that rural and urban schools contribute equally when it came to improvement in student achievement because the latter was found to be mostly associated with teacher variables, including efficacy. This longitudinal study spanned a period of three years and included 849 students, 97 teachers, and 21 rural and urban schools located in Western Australia. Young aimed to identify the characteristics of effective rural high schools by investigating factors which influenced students' achievement in mathematics and science. Young investigated school effectiveness, focusing on academic achievement and teacher morale as a reflection of educational environment (1998). Student participants completed a questionnaire featuring queries into their background, socioeconomic status, and rural life; in addition, students completed a combined test in mathematics and science. The participating teachers completed a teacher questionnaire which consisted of the *School Level Environment Questionnaire* (SLEQ), including 8 scales, 56 items, and demographic background questions. Study findings revealed that variability between schools, in relation to student achievement, was minimal once adjustments were made for effects of students' backgrounds. Rural and urban schools reflected similar levels of student achievement, and student achievement was mostly influenced by teacher variables, specifically teacher efficacy. Specifically, the researchers found that there were no residual school differences between rural and urban schools in terms of student achievement in mathematics and science. Young (1998) also found that there were also no rural/urban differences in student achievement after controlling for a student's background and previous achievement. Student achievement was more strongly connected to student and teacher variables, the latter including teacher efficacy. What teachers believe they can do or achieve helps to determine their actions. Both instructional and non-instructional actions are affected.

*Technology efficacy***.** Teacher efficacy plays a critical role in developing a positive school environment (Young, 1998). For this reason, and in consideration of teachers effectively implementing 21st century approaches to teaching and learning, it is also vital to consider yet another aspect of teacher efficacy – teachers' technology efficacy. Educational technology has already changed and will continue to change the ways in which teachers teach and students learn in 21st century classrooms (Irving, 2006; Sundeen & Sundeen, 2013). However, teachers' attitudes towards modern technologies greatly impact their effective use of these technologies to support school learning (Paraskeva et al., 2008). In a 2006 study, Paraskeva et al. investigated the relationship between teachers' general self-efficacy, self-esteem, and computer self-efficacy (CSE). The researchers also explored the relationships between teachers' subject area, their prior experience, use of software as educational tools, prior computer training, and computer selfefficacy. Participants in the study included 286 secondary education teachers covering various subject areas. The General Perceived Self-Efficacy Scale (Schwarzer & Jerusalem, 2000), The Rosenberg Self-Esteem Scale (Blascovich & Tomaka, 1991), and the Computer Self-Efficacy

Scale (Murphy, Coover, & Owen, 1989) were each used for data collection. Study findings assert that there is a positive correlation between teachers' general self-efficacy and their technology self-efficacy; the higher a teacher's general teaching self-efficacy, the higher was their technology self-efficacy. In addition, study data assert that using software for educational purposes significantly contributes to an increase in technology self-efficacy.

Teachers' computer self-efficacy contributes to their levels of technology use. However, Vannatta and Fordham (2004) suggest that teachers' dispositions (including self-efficacy) also predicted classroom technology use. The researchers examined various teacher temperaments that predict technology use among teachers in a K-12 setting. Data were collected from 177 teachers in six Northwest Ohio schools. The Teacher Attribute Survey measured various teacher attributes, including teacher self-efficacy, philosophy, amount of professional development, amount of technology use in the classroom, and openness to change. The researchers used forward multiple regression to determine the best combination of variables that predicts classroom technology use among K-12 educators. Findings of this study indicate that amount of technology training, time spent beyond the five-day school week, and openness to change are the best predictors of teachers' technology use in the classroom. This study supports the argument that technology training and teachers' attitudes greatly impact technology use in school settings.

Teachers who reflect positive attitudes and perceptions, in addition to high rates of selfconfidence regarding technology use may be more likely to use technology for instructional purposes (Holden & Rada, 2011). The Technology Acceptance Model (TAM) (Davis, Bagozzi, & Warshaw, 1989) represents how users come to accept and use a certain technology; this model is applicable to teachers' use of educational technologies. As previously mentioned in this literature review, Holden and Rada (2011) extended the TAM to incorporate teachers' perceived usability and self-efficacy measures regarding technology they were currently using, and found that teachers' technology self-efficacy (TSE) was more beneficial to the TAM than their computer self-efficacy; that is, teachers' technology self-efficacy had a higher influence on their technology use than their computer self-efficacy.

Professionals of the 21st century think and act differently compared to earlier decades (Ertmer & Ottenbreit-Leftwich, 2010); to some extent, this is as a result of the new tools and technologies available to them. However, when teaching and learning, and despite access to computers and technology training, technology is not being used to support the instructional strategies proven to be the most powerful (Ertmer & Ottenbreit-Leftwich, 2010; Rakes et al., 2006). Unfortunately, in spite of significant investments in technology developments, the presence of technology has not changed teaching and learning for the students (Bradshaw, 1997). With the guidance and opportunity provided by their schools, teachers must overcome barriers to the implementation of the most effective approaches to teaching and learning enhanced by the incorporation of technology. Teaching for the 21st century is ineffective if technologies are excluded from the process; to address this issue, teachers' mindsets toward innovation must be changed. In order for students to experience instruction consistent with today's educational demands, teachers' instructional habits must provide them with significant opportunities to be inventive and to apply knowledge in various ways (Hardiman, 2012). Technology integration is very important. The effective incorporation of technologies into educational practices will help to create increased engagement for students of the digital age and strengthen the relationships between students and teachers, who may not be a product of the digital age (Holden & Rada, 2011).

Teacher Actions

Teacher quality influences the actions teacher choose to carry out for non-instructional and instructional purposes. How teachers interact with their students, and the relationships they nurture can directly affect student achievement (Brophy & Good, 1984; Kiefer, 2014). In a descriptive qualitative study, Kiefer et al. (2014) investigated the ways teachers supported young adolescents' academic motivation. Data gathered in this study included 24 individual interviews of participants. The sample group consisted of 18 students, five teachers, and one middle school assistant principal. Findings from this study suggest that student academic motivation is likely supported by teacher-student relationships, teacher expectations, and instructional practices responsive to students' basic and developmental needs. According to Kiefer et al. (2014), the potential for educators to meet the needs of their students and support their motivation may be maximized when such expectations and instructional practices are implemented within the context of high-quality teacher-student relationships. Teachers' non-instructional actions matter for student improvement; they can affect students positively or negatively.

A focus on teachers' instructional actions is also critical. Wallis and Steptoe (2006) state that success in today's society not only demands high competency in traditional academic disciplines such as competency in reading and mathematics but also 21st century skills. Twentyfirst century-ready schools must actively embrace practices and policies supporting the teaching and learning of important 21st century skills. These institutions readily approach learning with the intent to equip students with the knowledge and tools they need to collaborate, create, think critically, analyze, evaluate, solve and manage problems, while using technology in a society made up of individuals from varying ethnicities and backgrounds. Today's schools must put greater emphasis on teaching children to collaborate and solve problems in small groups as well as apply what they have learned in real world situations (Wallis & Steptoe, 2006).

Technology Integration

The instructional strategies and methods of teachers affect the level of teaching and learning which takes place. For instance, there is a positive relationship between levels of classroom technology use and the use of constructivist instructional methods when it comes to rural student achievement (Rakes et al., 2006). In a 2006 study, researchers investigated the relationship between the use of constructivist instructional practices and technology skills and use among teachers in rural schools. Findings illustrate that there is a positive relationship between personal computer use, and levels of classroom technology use. Participants in this study included 123 teachers from 36 elementary schools, 17 middle/junior high schools and 13 high schools. Technology and professional development were provided for a year before survey data were collected from teachers. This study provides information from several teachers across 11 rural school districts. Findings of this study reveal that teachers who possess solid basic computer skills and comfort levels with technology as well as those who use computer technologies in their classrooms are more than likely to employ constructivist teaching methods. The researchers also note that the mere availability of computers and training do not result in automatic and widespread use of technology. On the other hand, Rakes et al. (2006) suggest that teacher beliefs regarding their abilities to use technology effectively and their beliefs regarding the effect on student achievement are significant factors which greatly impact the technology integration or lack of such in the classroom.

Teacher Development

Effective teacher development positively impacts teacher quality. Both teacher knowledge and beliefs can be influenced. As such, teacher development is critical to effectively for a school. Rural schools need to be supported in new ways so that students become productive members of an ever-changing society (Bouck, 2004; Mishra & Koehler, 2006); a focus on teacher development is likely to prove beneficial. In the absence of uniformed teacher preparation programs across the nation, rural schools are able to improve the quality of their teachers through effective teacher development (Guskey, 2002, 2014; Guskey & Yoon, 2009; Unruh & Holt, 2010). Providing teachers with adequate and appropriate opportunities to expand their knowledge bases is likely to enhance the quality of teaching and learning offered in their classrooms. Supportive school environments are quite beneficial in terms of developing and maintaining high-quality teachers. In fact, teachers working in a more supportive professional environment are more likely to improve their effectiveness over time than teachers who work in less supportive contexts (Kraft & Papay, 2014).

Creating a school environment supportive of teacher development should be a priority for all rural schools. Rural teachers need to be able to work with fellow teachers, receive feedback on their performances, and engage in meaningful self-reflection as means to improving their performances. In 2014, Kraft and Papay studied teachers and schools in a large urban public school district in North Carolina. This district employed over 9,000 teachers, in 174 schools and served more than 141,000 students. Study data were drawn from an analytic sample made up of students in the fourth through eighth grades who could be matched to their mathematics teachers. Student achievement data were linked to teachers and combined with teachers' responses on the

North Carolina Teacher Working Conditions Survey, a 100-plus item questionnaire. This survey was administered in 2006, 2008, and 2010. Survey response rates were 46%, 67%, and 77% respectively over the three-time administration. This included 280,000 student observations and 3,145 teachers. This study found that school environments in which teachers have the opportunity to collaborate frequently, receive meaningful feedback about their instructional practices, and are recognized for their efforts will promote teacher improvement at a faster rate than schools where such practices are not offered (Kraft & Papay, 2014). Findings indicate that on average after 10 years, teachers in the 75th percentile of professional environment ratings improved 38% more than teachers in schools at the 25th percentile. This study implies that more supportive rural school environments would yield greater returns in terms of teacher preparation and development, and subsequently student academic performance.

In today's society, it is necessary for teacher support and professional development to address technology implementation. Technology focused learning opportunities are vital to teachers and are likely to influence their effective use of technology. Teacher development is a significant factor which contributes to the school environment (climate and culture) present in a school and the educational experience that students are offered. Improving how teachers behave in instructional and non-instructional capacities can directly shape the environment of a school and significantly impact how much students learn. Rural schools must make teacher development, specifically technology training, relevant and meaningful for teachers and their students.

In addition to teacher quality, teacher development can have positive impacts on teacher efficacy. Studying 83 first-year traditionally certified (n = 63) and alternatively certified (n = 20) teachers, across 12 school systems in western North Carolina, Unruh and Holt (2010) highlight that while each group of teachers had differing needs, self-efficacy was higher for both groups when the teachers were provided with strong beginning support services, such as instructional skills professional development. This support also increases the likelihood of these teachers continuing in the teaching profession (Unruh & Holt, 2010) and having better student outcomes (Kee, 2012).

Conclusion

In order to be successful, schools must seek to meet the demands of the times in which they exist and for which they must prepare students to perform, achieve, and excel. Therefore, changes in society result in changes in educational demands (Ertmer & Ottenbreit-Leftwich, 2010; Koehler & Mishra, 2009; Yapici, 2016)). Today's 21st century society is technologically driven. As such, it is important for students' educational experiences at all levels and in all geographic locations to effectively integrate technology.

Nathan (2004) highlights that the public school system is designed to be accessible by every student, regardless of religion, wealth, disability or race. However, students attending substandard schools, such as many schools located in rural areas, do not have equal access to adequate educational opportunities (Liu, 2006). They do not receive the same funding, and do not have similar access to resources including technology and high quality teachers (DarlingHammond, 2000b) who can effectively integrate technology in the processes of teaching and learning. Therefore, while all students are given access to a public school education, access to resources such as technology and high quality teachers who integrate technology into their instruction is not equal.

While noting that the effects of unequal access can be seen in various inequalities which have manifested in the poor performances of students enrolled in rural schools, Truscott and Truscott (2005) assert that the challenges faced by rural schools are very similar to that of their urban counterparts. However, several factors contribute to more attention being paid to the struggles of the schools in urban areas. These factors include major media outlets being located in urban areas, denser populations in urban areas resulting in challenges being more visible, and more voters concentrated in cities (Truscott & Truscott, 2005). Research indicates that students who reside in rural areas show lower educational achievement and are more likely to drop out of school (Roscigno et al., 2006). To help address these issues and increase student achievement, rural schools must adapt policies and practices which promote and foster 21st century learning experiences for all students. An ideal way to address such a feat is to bolster teacher quality; rural schools must make investments in the quality of teachers they place in students' classrooms. Rural teachers must be equipped with the knowledge and skills needed to perform as effective educators in a digital world.

Rapid changes in technology have affected the role of teachers and influenced physical changes in classrooms and schools (Yapici, 2016). There are several benefits to be gained from the effective integration of technology in today's classrooms; technology can impact student achievement in several meaningful ways such as personalizing learning and providing additional educational supports. However, teachers who have been teaching through traditional methods cannot be expected to readily or immediately adapt to technology integrated methods without guidance and support.

Rural schools must address several issues – from financial support to curriculum revision and from teacher quality to community involvement (Bouck, 2004). Tackling these challenges is a significant part of preparing rural students for success in the 21st century. Several factors affect both teachers and students in rural areas, hindering or improving the abilities of individuals in both groups to be 21st century ready; one of these factors is school environment. Rural geographic location, community involvement, school leaders' actions, teacher development, teacher quality, and teacher efficacy each contribute to school environment. This study explores these factors, specifically focusing on the impact of technology professional development on teachers' technology self-efficacy and resultant technology integration in lessons across all content areas.

Chapter 2 Needs Assessment

The previous chapter identified and discussed various issues which affect rural school environment. These factors included geographic location (Brownell et al., 2005), diversity issues (Reed, 2010; Yeo, 1999), financial struggles (Brownell et al., 2005, Bouck, 2004) and teacher quality (Bouck, 2004; Rivkin et al., 2005; Robinson, 2008). In order to successfully prepare rural students for the 21st century, rural schools must meet the responsibility of responding to these challenges. In fact, research explored in Chapter 1 showed that by using innovative technology integration to enhance the teaching and student learning which takes place, rural schools have the capability of improving the educational experiences they offer to rural students (Bauch, 2001). As such, rural schools are in need of teachers who are capable of effectively integrating technology for instructional purposes. In today's society, such knowledge and skills are essential to high teacher quality (Koehler & Mishra, 2009; Mishra & Koehler, 2006). With a specific focus on teacher quality, this dissertation study explores the idea, that guided by their schools, rural teachers must be equipped with the relevant technology knowledge and skills to function as qualified and effective educators in a technology integrated society.

In particular, this needs assessment sought to establish teachers' technology use and levels of student achievement at one rural school which had recently invested in various technology resources. Because teaching for the 21st century is ineffective without successful technology implementation, this needs assessment also sought to determine the kind of technology supports that teachers at the school believe they needed. Both quantitative and qualitative data were collected and analyzed.

Study Site and Target Population

The study site for this needs assessment is a high school located in a rural southeastern state. This high school represents the largest of four in a school district of approximately 7,000 students and enrolls students from grades nine through twelve. There are approximately 1,100 students enrolled in the school and about 90 faculty and staff members. The student population is predominantly African-American (94.4%), and all students receive free lunch.

In recent years, the local school district has made several changes at the high school in efforts to improve the school's poor performance, specifically, its levels of student achievement on end of year tests. Though not on probation, as of 2012, the school has only managed to earn an Average rating on its state report card each year. Changes at the school include a new principal and increased technology resources. In 2013, the study site was one of three schools in the district to earn a Race to the Top Grant, and this status has afforded the school access to additional resources toward school improvement. In addition to the traditional faculty and staff members, there are three employees attached to the Consortium for Enterprise Learning (CCEL) who are housed at the school. This group leads grant implementation at each of the eligible schools in the district. The three offices housed at the study site include that of the CCEL district level supervisor, as well as an Enterprise Learning Coach and Digital Learning Coach, both of whom are directly assigned to the school. Using funding from the Race to the Top grant, the district purchased a laptop computer for each student at the school. In addition to the recent investment in laptop computers, in the last ten years, the school has purchased and installed interactive smartboards, LCD projectors, and lumens document cameras in 90% of classrooms (M. Morgan-Smalls, personal communication, April 27, 2017). Technology-based programs such as Mastery Connect and Nearpod have also been acquired. Mastery Connect is an online resource that assists teachers in identifying and tracking students' mastery of state standards in order to inform instruction. Nearpod is an interactive presentation and assessment tool. Using Nearpod, teachers can create presentations which include polls, videos, quizzes, images, and web content. School leaders at the study site encourage teachers to use these technologies to enhance the teaching and learning which occurs in their respective classrooms but were never given more than one time PD sessions with no follow up technology training (K. Gordon, personal communication, April 27, 2017).

Proposed Research Questions

The following research questions directly relate to the need of rural schools to address teacher quality in terms of providing rural students with teachers who are capable of enhancing teaching and learning through technology integration.

RQ1 – What is the difference in student achievement on end of course tests before and after the introduction of various instructional technology resources at the study site?

RQ2 - How often do teachers integrate available technology resources in their lessons and at what levels of technology implementation, as outlined by the SAMR model and LoTi framework?

RQ3 – What kinds of technology strategies for instruction do teachers indicate they need?

Methodology

A convergent mixed method design was implemented to investigate the research questions previously outlined. This design was chosen so that needs assessment findings would be more likely to tell a whole story. The raw data collected from quantitative sources would be further supported or refuted by the corresponding qualitative data. Data collected included quantitative and qualitative sources from semi-structured interviews, classroom observations, and annual school report cards. These data were collected and analyzed separately, then their findings were compared. The annual school report cards for three consecutive years (2014, 2015, and 2016) were retrieved from the State Department of Education's online archives. These data provided information on school performance on end of course tests in four subject areas, as well as, school performance on three college and career readiness tests. Specifically, the subject areas of focus were English, biology, U.S. history and the constitution, and algebra. The college readiness tests were ACT and SAT, and the career readiness test was ACT Workkeys.

In addition to reviewing the annual school report cards, the researcher conducted eight classroom observations using the AdvancED (2014) Effective Learning Environments Observation Tool (ELEOT) and four semi-structured teacher interviews using a protocol (Appendix A) to observe levels of technology implementation and identify teacher's perceptions of the benefits of technology integration. Live coding was used to gather and present teachers' direct comments which address exactly how technology resources are being used to support student achievement at the study site and whether technology professional development is considered beneficial by the teachers. That is, the researcher assigned labels to the different teachers' comments, then grouped them according to similarity. Infrequent comments, that is teachers' comments which did not follow a pattern or theme, were also coded. The observations and interviews helped to ascertain teachers' beliefs and behaviors about teacher development and classroom technology use and the resulting technology integration which does or does not take place.

Procedure

This needs assessment gathered data to examine the performance of the school over a period of three academic years from 2014 to 2016, indicating achievement before the introduction of the one-to-one technology device initiative in 2015, as well as achievement with this initiative in place. In addition, data was collected to better understand teachers' use of technology and their self-reported perceptions of their self- efficacy to effectively employ such devices in their classrooms. Lastly, data indicating teachers' current levels of technology implementation were also collected.

Data Collection and Instrumentation

Three methods of data collection were used. The researcher conducted classroom observations and teacher interviews. In addition, the researcher analyzed extant data regarding school performance and student achievement from 2014 – 2016. In terms of instrumentation, the Effective Learning Environments Observation Tool or ELEOT (AdvancED, 2014) served as the instrument to collect data during the eight classroom observations. AdvancedED revised this observation tool in 2014. It is a student-focused observation tool consisting of seven sections and each section has 3-5 questions with four Likert Scale responses: very evident, evident, somewhat evident, and not observed. The sections of the observation tool collected data regarding the kind of learning environment being fostered by the teacher. Sections on the ELEOT include: equitable learning environment (A), high expectations environment (B), supportive learning environment (C), active learning environment (D), progress monitoring and feedback environment (E), wellmanaged learning environment (F), and digital learning environment (G). Specific attention was given to Section G. In addition to the ELEOT, the LoTi framework (Moersch, 1995; 2010) and SAMR model (Puentedura, 2010) were referenced in order to help categorize current levels of technology integration.

Four teachers were engaged in semi-structure interviews. Each interview lasted approximately 15-25 minutes, and each interviewee was asked the same questions regarding the technology integration practices in their classroom and at the study site on a whole. Each interview began with the same set of six questions; however, additional discussions occurred based on teachers' responses. The researcher gathered notes from each interview. Teachers answered the initial set of questions listed below:

1. How satisfied are you with the levels of interest in learning shown by your students?
2. How satisfied are you with the availability of technology resources at this school?
3. How often do you use technology to enhance instruction?
4. In your experience, does student engagement increase during technology integrated instruction?
5. In your experience, does technology integration lead to improved student performances?
6. When it comes to using technology to enhance instruction, how prepared and knowledgeable are the teachers at your school?

Conducting teacher interviews was important as this data helped the researcher to analyze teacher quality as it related to using technology for instructions. The semi-structured interviews gave teachers a voice. They had the opportunity to share their opinions regarding technology integration at the school and speak on the degree of preparedness that they believe they and their colleagues possess when it comes to using technology to enhance instruction. The researcher also intended for data gathered in the teacher interviews to help explain the extant data collected from the annual report cards.

Needs Assessment Findings

Teacher quality contributes to the culture and climate of a school and helps to dictate the achievements and/or failures schools experience. Various factors determine teacher quality; these include teacher preparation, teacher development, and teacher efficacy. In 2015, the study site embarked on a plan to improve student achievement through technology use. However, teachers did not participate in extensive professional development regarding how best to use these technological devices to enhance teaching and learning. While technology professional development was offered, sessions were not consistent and on-going. It was also not mandatory for teachers to attend all sessions (Morgan-Smalls, personal communication, February 24, 2017). Despite access to various technologies, “Teacher quality and student achievement have not benefitted from technology integration at the study site” (Gordon, personal communication, February 27, 2017). The following section presents findings gathered from the school achievement data, classroom observations, and teacher interviews.

School Achievement Data from Annual State Issued Report Card

The State Department of Education (SDE) issues school report cards annually. Schools are assessed and their progress toward realizing the state’s Performance Vision for 2020 is determined. The vision states that “By 2020 all students will graduate with the knowledge and skills necessary to compete successfully in the global economy, participate in a democratic society and contribute positively as members of families and communities” (SDE, 2014, p. 1). Two important ratings on the annual school report card are the Absolute rating and the Growth rating. The absolute rating reflects the overall current year performance of the school, while the growth rating describes the progress of the school from the previous year to the current year. The state vision does not list specific 21st century skills nor does it make a distinct reference to technology; however, the SDE provides a target profile of a high school graduate from the state. This profile identifies three categories of expertise for graduates: world class knowledge (rigorous standards in language arts and mathematics for career and college readiness, multiple languages, science, technology, engineering, mathematics (STEM), arts, and social science), world class skills (creativity and innovation, critical thinking and problem solving, collaboration and teamwork, communication, information, media, and technology, and knowing how to learn) as well as, life and career characteristics (integrity, self-direction, global perspective, perseverance, work ethic, and interpersonal skills). The importance of technology integration is evident in these goals. By 2030, the state aims to have 90% of students graduating from high school college or career ready (SDE, 2016).

On the report card, the school rating terms are Excellent (School performance substantially exceeds the standards for progress toward the 2020 Performance Vision), Good (School performance exceeds the standards for progress toward the 2020 Performance Vision), Average (School performance meets the standards for progress toward the 2020 Performance Vision), Below Average (School performance is in jeopardy of not meeting the standards of progress toward the 2020 Performance Vision), and At-Risk (School performance fails to meet the standards of progress towards the 2020 Performance Vision).

For this needs assessment, the three most recent report cards were reviewed. This list includes report cards from 2014-2016. Looking at three years of data provides more data, a longer time line, and perhaps reduces the risk of analysis being influenced by outliers or unusual happenings which could occur during a one year period. Because the extant data only presents averages, the researcher could not perform any difference of means tests and will analyze the data to determine whether there is evidence that suggests a pattern of performance by students enrolled at the study site. In addition, a snapshot of school performance over this three-year period illustrates school performance with the availability of various technology resources. During this three year period, the high school implemented significant technology resources, providing an opportunity to examine the effects (if any) of this influx of technology resources. Technology resources accessible to teachers included interactive smartboards, Mastery Connect, and LCD projectors. This snapshot also indicates levels of student achievement prior to the introduction of the one-to-one device program (2014), performance during the first year of adoption (2015), and most current performance (2016).

2014 School report card. In 2014, the school received an absolute rating of Average. The growth rating was also Average, improving from At-Risk in the previous year (SDE, 2014). The overall Elementary and Secondary Education Act (ESEA) Waiver grade for the 2014 year was C, which was an improvement from an F in 2013 (SDE, 2013). ESEA Waiver grades range from A to F. Though this high school experienced academic improvements, school, district, and state testing data indicate that there are areas in which students still struggle (SDE, 2014). The state testing data suggests that students at the school may possibly perform below the state average calculated for similar high schools within the state (SDE, 2014). Tested areas include biology, mathematics, English, and U.S. history. However, the On-Time Graduation Rate of 370 is above the average (150) of similar high schools in the state (SDE, 2014).

End of course (EOC) testing 2014. Students at the study site complete state end of course examinations in four subject areas. These areas include algebra, English I, biology I, and U.S. history and constitution. Each student enrolled in these courses is required to complete the respective End of Course test. The 2014 report provides a comparison of student performance at the study site to high schools with similar student populations. Table 3 illustrates this comparison.

Table 3

2014 School Performance on End of Course Tests

	% Of Students with Scores of 70 or Above	
	Study Site	High School with Similar Student Population
Algebra 1/Math for the Technologies 2	74.6	73.6
English 1	58.3	56.2
Biology 1/Applied Biology 2	56.5	65.1
U.S. History and the Constitution	48.3	47.3
All Subjects	57.4	60.4

2015 **School report card.** In 2015, the State Department of Education changed the structure and format of the report cards they issued to schools. Absolute ratings, growth ratings, and an overall letter grade were omitted. The state will not resume the use of these ratings on school's annual report cards until 2018 (SDE, 2016). However, the state continues to document the academic performance of the school. Instead of comparing schools to high schools with similar students, report cards now provide comparisons in relation to schools in its district and the state. Comparisons are made for student performance on end of course tests in algebra, English, biology, and U.S. history and constitution. In addition, the 2015 report card provides information on student achievement regarding three college and career readiness assessments.

The assessments include the American College Testing (ACT) exam, the ACT Workkeys assessment, and the Scholastic Aptitude Test (SAT).

End of course (EOC) testing 2015. The 2015 report card shows student achievement data in four subject areas: algebra I, English I, biology I, and U.S. history and constitution. Each student enrolled in these courses must complete the respective end of course test. Table 4 illustrates the percentage of students who passed the standardized exam by receiving a score of 70 percent or higher. Information for each of the subject areas tested is provided.

Table 4

2015 School Performance on End of Course Tests

% Of Students with Scores of 70 or Above	Study Site	District	State
Algebra/Math for the Technologies 2	60.8	74.5	85.7
English 1	43.8	58.7	75.1
Biology 1	65.8	66.3	77.8
US History and the Constitution	56.5	54.0	69.1
All Subjects	56.0	63.5	77.3

American college testing (ACT). In 2015, the American College Testing (ACT) test was administered at the school for the first time. The state now requires that all students in the eleventh grade sit for this examination during the spring semester of the school year. Only students identified for alternative assessments are exempt from taking this exam during their junior year of high school. Scores on the ACT range from 0 to 36, where 36 represents high academic achievement and the best student performance possible. The average score achieved by students in each section of the test: English, reading, mathematics, and science is shown in Table 5.

Table 5

2015 Average ACT College Entrance Exam Score Achieved by Students

	Study Site	District	State
English	14.1	13.9	16.5
Mathematics	15.8	15.9	18.1
Reading	15.8	15.5	18.3
Science	15.7	15.6	18.2
Composite	15.5	15.4	17.9

American college testing - Workkeys. The ACT Workkeys is a job skills assessment system and measures students' "real world skills" which employers believe to be critical in the work place (SDE, 2015). Similar to the administration of the ACT, students complete the ACT Workkeys assessments in the eleventh grade. Students' scores on these assessments earn students certificates at the platinum, gold, silver, and bronze levels; these levels correspond with the skill requirements of ACT-profiled jobs in the ACT JobPro database (ACT, 2014). The highest score on each section of this assessment equals a Level 7 rating. A platinum certificate indicates that a student scored at Level 6 or higher on all three exams; a gold certificate indicates that a student scored at Level 5 or higher on all three exams. A silver certificate corresponds with Level 4 or higher scored on all three exams, and a bronze certificate corresponds with Level 3 or higher on all three exams. Three areas are tested; they include applied mathematics, reading for information, and locating information.

Table 6

2015 Percentage of Students Meeting Platinum, Gold, or Bronze Threshold on ACT Workkeys

	Study Site	District	State
Applied Mathematics	57.8	57.1	73.4
Reading for Information	88.7	89.1	93.5
Locating Information	78.8	80.2	87.7

Scholastic aptitude test (SAT). The highest composite score on the SAT is 2400. The test is made up of three sections, each worth 800 of the total score. In 2015 51.5% of students at the study site were tested. Table 7 shows that the average critical reading score for students at the study site was 422, 73 points less than the state average of 495 in that area. The average mathematics score was 412, 99 points less than the mathematics state average of 511. The average writing score was 410, 74 points less than the writing state average of 484. The average composite score for students at the study site was more than two hundred points (246) less than the state average; it was 1244, while the state average composite score was 1490.

Table 7

2015 Average SAT Score for the Study Site and the State

	Study Site	State
Average Reading	422	495
Average Mathematics	412	511
Average Writing	410	484
Average Composite	1244	1490

2016 **School report card.** The 2016 report card suggests that the study site continues to illustrate a pattern of lower performances in comparison to other schools in the state. As in the 2015 report, comparisons are presented for student performance on end of course (EOC) tests in algebra, English, biology, and U.S. history and constitution, ACT, ACT Workkeys, and SAT.

End of course (EOC) testing 2016. Students at the study site completed state end of course examinations in four subject areas. These include algebra, English I, biology I, and U.S. history and constitution. Study site and state percentages are presented in Table 8.

Table 8

2016 School Performance on End of Course Tests

% Of Students with Scores of 70 or Above	Study Site	District	State
Algebra/Math for the Technologies 2	50.8		82.4
English 1	53.5		78.9
Biology 1	50.6		75.9

U.S. History and the Constitution	51.9	71.2
All Subjects	51.5	77.3

**In 2016 District Averages were not reported.*

The percentage of students who passed the assessment in each of the areas tested was less than the number of students in the state who did the same. District percentages where not provided in the 2016 report.

American college testing (ACT). The average American College Testing (ACT) score achieved by students was less than both the district and state averages. The score achieved by students in mathematics was equal to the district average but less than the state average. Table 9 illustrates student performances at the study site, compared to the student performances in the district and state.

Table 9

2016 Average ACT College Entrance Exam Score Achieved by Students

	Study Site	District	State
English	14.2	14.3	16.8
Mathematics	15.9	15.9	18.4
Reading	15.6	15.9	18.6
Science	16.4	16.5	18.6
Composite	15.7	15.8	18.2

American college testing - Workkeys. A comparison of student performances at the study site and students in the district and the state is illustrated in Table 10. A comparison of the percentages of students meeting the platinum, gold, or bronze threshold for the study site reflects differences of 29.4%, 6.5%, and 18.5% for applied mathematics, reading for information, and locating information respectively. Although the study site's percentages in these areas are closer to the district averages, the district percentages are also less than the state percentages by 6.9%, 3.9%, and 3.8% in applied mathematics, reading for information, and locating information respectively.

Table 10

2016 Percentage of Students Meeting Platinum, Gold, or Bronze Threshold on ACT Workkeys

	Study Site	District	State
Applied Mathematics	43.0	49.9	72.4
Reading for Information	87.4	91.3	93.9
Locating Information	58.3	62.1	76.8

Scholastic aptitude test (SAT). In 2016 only 33.1% of students at the study site completed the Scholastic Aptitude Test. The highest score possible on each of these tests is 800; the highest composite score that can be achieved is 2400. Table 11 shows the study site's average score in each tested area as compared to the state average.

Table 11

2016 Average SAT score for the Study Site and the State

	Study Site	State
Average Reading	411	494
Average Mathematics	406	508
Average Writing	405	482
Average Composite	1222	1484

The average critical reading score was 411, 83 points less than the state reading average of 494. The average mathematics score was 406, more than 100 points less than the mathematics state average of 508; and the average writing score was 405, 77 points less than the writing state average of 482. The average composite score for students at the study site was 1222 while the state average composite score was 1484.

As previously mentioned, the annual school report cards only provided the averages illustrated in the tables included in this needs assessment. Evidence appears to suggest a pattern of the study site most often lagging behind other schools in its district and the state, in terms of student performances on the end of course examinations, ACT, ACT Workkeys, and SAT tests. A limitation of this extant data is that the researcher was unable to carry out any difference of means tests.

Data Analysis

This section analyzes the data collected during the needs assessment. Each discussion of the findings is presented in relation to the research question that particular data sets were intended to address.

RQ 1 What is the difference in student achievement before and after the introduction of various technologies at the study site?

A comparison of the 2014, 2015, and 2016 student achievement data from end of course examinations relies on limited extant data that suggests a pattern of generally low and continuously declining student achievement. For these years, the EOC test format in each of the tested areas was the same. Students in each of the three years were administered a similar examination for each respective content area. The single exception is seemingly in English I, where a 2015 decline of 14.5% in 2015 (from 58.3% to 43.8%) was improved by 9.7% in 2016 (43.8% to 53.5%). The percentage of students passing the algebra EOC has decreased from 74.6% in 2014, to 60.8% in 2015, to 50.8% in 2016. Passes in biology improved from 56.5% in 2014 to 65.8% in 2015 but dropped to 50.6% in 2016. While student performance in U.S. history improved from 48.3% in 2014 to 56.5% in 2015; the percentage of students passing in 2016 dropped to 51.9%. The percentage passing for all subjects did not change significantly from 2014 to 2015 (57.4% to 56%) but declined to 51.5% in 2016. These findings are illustrated in Table 12 which is a compilation of the study site's EOC data from Tables 3 (2014), Table 4 (2015), and Table 8 (2016).

Table 12

Comparison of 2014, 2015, and 2016 School Performance on End of Course Tests

End of Course % of Students with Scores of 70 or Above	2014	2015	2016
Algebra/Math for the Technologies 2	74.6	60.8	50.8
English 1	58.3	43.8	53.5
Biology 1	56.5	65.8	50.6

U.S. History and the Constitution	48.3	56.5	51.9
All Subjects	57.4	56.0	51.5

There are no ACT data for the year 2014; however, a comparison of student achievement data from 2015 and 2016 is beneficial. This comparison is represented in Table 13 which is a compilation of the study site's ACT data from Table 5 (2015) and Table 6 (2016). Table 13 illustrates that from 2015 to 2016, there appears to have been very little improvement in performance on each section of the ACT. However, any increase recorded is questionable as far fewer students were tested in 2016. While 55.1% (n = 641) of students tested in 2015, only 33.1% (n= 362) sat for the ACT in 2016.

Table 13

Comparison of 2015 and 2016 Average ACT College Entrance Exam Score Achieved by Students

	2015	2016
% of Students tested	55.1	33.1
English	14.1	14.2
Mathematics	15.8	15.9
Reading	15.8	15.6
Science	15.7	16.4
Composite	15.5	15.7

From 2015 to 2016, student performance on the ACT Workkeys assessment also reflects a pattern of decreasing performances. Table 14 compiles the study site's ACT Workkeys data from Table 6 (2015) and Table 10 (2016). This comparison shows that in two of three categories, there is a drop in the percentage of students meeting platinum, gold, or bronze thresholds. In the assessment of Applied Mathematics, the decrease from 2015 to 2016 is 14.8%. While there is only a 1.3% increase, no significant change, in Reading for Information, there is a significant 20.5% decrease in Locating Information.

Table 14.

Comparison of 2015 and 2016 Percentage of Students Meeting Platinum, Gold, or Bronze Threshold on ACT Workkeys

	2015	2016
Applied Mathematics	57.8	43.0
Reading for Information	88.7	87.4
Locating Information	78.8	58.3

The study site is in its second year of its one-to-one laptop initiative and has also had various other technology resources, such as smartboards, available to teachers for several years. However, it would appear that the investment in technology has made little to no impact on student achievement at the school. Student performance in various academic areas suggests patterns of the study site often lagging behind the state average. In comparison to the other three high schools in the district, the study site often records performances equal to or below the district average.

RQ2 - How often do teachers integrate available technology resources in their lessons and at what levels of technology implementation, as outlined by the SAMR model and LoTi framework?

The classroom observations and teacher interviews conducted at the study site were used to gather information regarding teachers' use of the available technology resources. Teachers' instructional strategies were documented using the ELEOT. During eight (8) classroom observations (U.S. history, English, Mathematics, Spanish, Science) there were only three occasions when teachers' used technology. During one observation, students in an English class took notes during their teacher's PowerPoint mini-lecture. This type of technology implementation represents the lowest level of integration on the SAMR model (Puentedura, 2010) and in the Loti Framework (1995; 2010) and was also observed on two occasions in the same U.S. history class. U.S. history students also participated in a technology-driven review activity using an online educational program called Kahoot. During each of the two observations in the U.S. history class, students seemed engaged and willingly participating in the class activities. Kahoot was observed as an instructional strategy on both occasions in the U.S. history classroom; the teacher shared that students got excited and paid more attention when the teacher used this interactive technology to facilitate review sessions. He said, "The students pay attention more when it's time for the game. They like using their smartphones to answer the questions displayed on the smartboard. Sometimes they get on teams and try to outdo each other. More students get involved in the lesson" (Teacher O1, February, 2016). Kahoot is an online platform where students play a game on their smartphones and record answers to questions displayed on an LCD projector and smartboard. Students compete against each other to answer questions quickly and correctly. Questions can be created by the teacher or the teacher can use "public Kahoots" created and stored online by other users. The rigor of questions varies; questions can require students to simply recall information or to analyze and evaluate information in order to get to the correct responses. Students earn points based on the accuracy and quickness of their responses. The U.S. history teacher shared that the competitive nature of Kahoot also helped to get students involved in the review activity as they were motivated to find information in order to accurately answer questions and earn more points than their classmates. He said, "The students get pretty excited about Kahoot reviews. They are very competitive and intense, and they want to win. Beating their classmates in the game is serious to them" (Teacher O1, February, 2016).

During the other five classroom observations where students took written notes, interacted with the teacher, slept, or talked to their peers during instruction technology was not being used. Students also worked with textbooks and participated in class discussions with their teachers and peers. Students completed assignments using pen and paper and submitted them to teachers for grading. During the observations, students did not use the laptops assigned to them by the school. One teacher shared that the students often complained about having to bring their laptop to school every day. The student frustration may be due, in part, to the low levels of technology currently integrated into the instructional strategies which would require them to use their assigned laptops.

The technologies available at the school are not used on a daily basis and when technologies are employed, it is at the lowest levels of implementation. The SAMR model (Puentedura, 2010) identifies this use as substitution. In the classes that used the smartboard to display PowerPoint presentations, technology was not being used in innovative ways to promote 21st century skills such as critical thinking, but as a substitute to handouts, lectures or the teacher writing on the whiteboard, which is evident of the second lowest level of technology implementation on the LoTi framework (Moersch, 1995; 2010), awareness. PowerPoint presentations were simply used to enhance teachers' lectures.

RQ3 – What kinds of technology development do teachers indicate that they need? Four teachers participated in interviews (2 English, 1 Spanish, and 1 Mathematics) and all the teachers responded to the same set of questions (Appendix A). The teachers were asked, "When it comes to using technology to enhance instruction, how prepared and knowledgeable are the teachers at your school?" For Question 6, the Likert Scale responses were: extremely prepared and knowledgeable, very prepared and knowledgeable, somewhat prepared and knowledgeable, not so prepared or knowledgeable, and not at all prepared or knowledgeable. One teacher reported that he thought teachers at the school were very prepared and knowledgeable; he said, "Yes, we have what we need." On the other hand, two teachers responded that teachers are somewhat prepared and knowledgeable, while the fourth teacher's opinion was that the teachers at the school were not at all prepared or knowledgeable when it came to using technology to enhance instruction. All four teachers shared that they had not participated in any training sessions regarding how best to use the laptops assigned to each student. One teacher commented that, "The students got the laptops, but they were not told how to use them; neither were we (the teachers)." Each of the teachers had a smartboard installed in his or her classroom; however, none of the teachers had participated in a training session to learn how to effectively use the available technology to enhance teaching and learning. One teacher said, "There were some sessions years ago when the school first started getting the smartboards but none recently." All the teachers interviewed shared the opinion that the technology resources available at the school were not being used in the most effective ways to enhance teaching and learning.

Throughout this analysis, in vivo coding was used to gather and report teachers' direct comments which suggested that despite their availability, technology resources were not being effectively used to support student achievement at the study site and that technology professional development would be beneficial for teachers. In addition to previously mentioned comments, teachers also said, "I think I could do more, if I knew how," "I am not sure how to integrate technology effectively" and "I think I can teach effectively without technology, but since we have it, I want to learn how to use it because my students like using technology." The teachers shared the opinion that their instructional strategies and that of their colleagues would be improved if they had the opportunity to participate in technology professional development, especially sessions which provided information and best practices regarding the technologies already available to them; "We (the teachers) would do much better with technology if we had the right training; there are so many possibilities, but we don't know how to use everything we have." Currently, technology is used at very low levels and requires little to no student interaction. There were only a couple teacher comments which did not support a need for technology professional development. One teacher said that, "Teachers needed more time to teach, not more professional development" and "Professional development is counterproductive because it often provides teachers with information we already know." However, the majority of teachers' responses indicate that teaching them (the teachers) how to use technology effectively and in a manner that facilitates student interaction would be beneficial to the teaching and learning which takes place in their classrooms.

Summary

The study site is not doing well academically. Student performances on various state tests and standardized college exams have been poor for the last three years. The adoption of one-toone devices, laptop computers, and other technology resources has not resulted in any significant benefits in terms of student achievement. In fact, student performance in various academic areas continues to trail behind state averages, as it did before the technology devices were introduced. Student achievement data from 2016 reflect poor performances, and there is no definitive conclusion that the introduced technology resources resulted in improved student achievement. When compared to the other three high schools in the district, the study site's levels of achievement are sometimes equal to the district average but are more often below the district average. In general, there has been no positive difference in student achievement as a result of the introduction of one-to-one laptop devices at the study site.

Classroom observations and teacher interviews reveal technology integration at low levels as a typical instructional strategy employed by some teachers at the school. Only two teachers were observed using the LCD projector and smartboard combination installed in 90% of the school's classrooms. No students were observed using their assigned laptop computers. When teachers integrated technology, students used their smartphones (those who had smartphones) and lessons were not innovative. Comments shared by the teachers during interviews indicate that teachers at the study site are not familiar with various technology integrated instructional strategies and do not understand the benefits of integrating technology their lessons.

In general, technology resources at the study site are being used very little and at the lowest levels of implementation (substitution) outlined by the SAMR model (Puentedura, 2010) and the LoTi framework (Moersch, 1995; 2010). Evidence suggests that teachers used the smartboard as a screen to display PowerPoint presentations or to facilitate the interactive Kahoot game being played. These uses are not innovative; technology is employed as a substitute method of presenting information. Teachers simply use technology to do the same activities that can be done without the technology.

Teachers at the study site have been provided with various technology resources; however, they have not been provided with opportunities to participate in ongoing and focused technology development. The teachers commented that they would do more with the technology if they had the technology knowledge and skills needed. The evidence gathered for this needs assessment highlights the importance of coupling technology purchases with technology professional development training for teachers. This professional learning opportunity for teachers may have been overlooked when the decision was made to introduce various technologies in efforts to enhance teaching and learning. As a result, teachers at the study site do not know how best to integrate the technology devices at their disposal in their daily lessons, and students have not benefited from their introduction. When it comes to effective technology integration, teacher quality is low. Teachers indicate that they would benefit from ongoing, focused technology professional development. The teachers need genuine opportunities to learn about the technologies at their disposal and how best to effectively incorporate them in daily lessons and in their respective content areas.

Constraints and Implications

The researcher's position as an educator at the study site could have influenced responses from teachers interviewed and whose classes were observed during observations. The researcher is a department chairperson and has been a teacher at the school for over ten years. It is possible that in some instances, individuals interviewed may not have provided completely honest responses and instead shared responses just as a favor to the researcher but not taking the interview questions seriously. Also, in hindsight, the interview questions employed for the teachers' semi-structured interviews were leading questions, and this could have influenced the teachers' responses.

In addition, class periods at the study site are ninety minutes long. The researcher conducted classroom observations which lasted approximately twenty minutes on each occasion. Even though technology integration was limited during the times of the observations, there is not enough evidence to determine what occurred or did not occur with technology during the other seventy minutes of class time. There is also the possibility that teachers required that students used their assigned laptop devices on days that their classes were not observed by the researcher. Finally, extenuating circumstances, such as a high principal and teacher turnover rate at the study site could have contributed to the study site's low student achievement over the three-year period researched.

A third limitation of this needs assessment was the researcher's inability to conduct any difference of means tests using the student achievement data gathered from the three annual school report cards. Each report card only presented averages of student performances in each of the tested areas, and this was not enough information to conduct meaningful statistical tests. As such, the researcher was only able to discuss the study site's suggested patterns of lower student achievement when compared to other high schools in the district and he state.

Chapter 3

Supporting Teacher Development

This chapter explores suggested solutions to address the lack of effective technology integration for instructional purposes at a rural high school. A positive school environment plays a critical role when it comes to the nurturing high levels of student achievement (Barley & Beesley, 2007; MacNeil et al., 2009). In order to improve school environment (climate and culture) in rural environs, various policies (adopted principles of action) and practices (actual application or method of use regarding established policies) supporting teacher development must be acknowledged and implemented in these schools. School culture refers to the values and norms of a school, while climate involves the behaviors of administrators, teachers, parents, students, and other stakeholders (MacNeil, et al., 2009). School climate and culture can be improved through effective teacher development because teacher development greatly contributes to teacher quality, which is a significant factor affecting school environment. Teacher development focused on effective technology integration is needed at the study site.

Teacher development is an important factor which helps to determine teacher quality (Bell & Gilbert, 1994). As defined by Bell and Gilbert (1994), teacher development refers to teacher learning and can be considered as purposeful inquiry. Through this learning, teachers develop their beliefs, ideas, classroom practices, and reflect on their feelings associated with change (Bell & Gilbert, 1994; Evans, 2002). In a three-year research project focused on improving teacher quality, Bell and Gilbert (1994) identified two key parts of teacher development. Part one consisted of the input of new theoretical ideas and new suggestions for teaching. Part two referred to teachers having the opportunity to try out, evaluate, and practice these new theoretical ideas and teaching suggestions over an extended period of time, in a situation that promoted collaboration, and in which teachers had access to support and feedback, and were able to reflect critically. Data for this study were gathered from 48 K-12 teacher participants in the Learning in Science Project (Teacher Development) in New Zealand. Researchers administered surveys, conducted interviews, completed classroom observations, and facilitated discussions to gather information regarding the adult learning process as it related to teacher development. The study's main findings indicate that teacher development includes professional development, personal development, and social development.

This review focuses on the improvement of teacher quality at the study site. Focus is placed on improving teacher quality to meet 21st century educational demands in terms of effective technology integration to enhance teaching and learning. Specifically, emphasis is placed on how teachers' technology efficacy, technology use, and resultant levels of technology implementation can be improved through teacher development efforts. Improving teacher quality is an ideal method by which to improve the performances of rural students and rural schools in general. To improve the quality of teachers in a school, teachers must be provided with opportunities for professional growth; teacher development is very important.

Findings from the needs assessment indicate that teachers at the study site need opportunities for technology development and growth. In particular, the needs assessment revealed that:

- A pattern of low student achievement from 2014-2016.
- The use of various technology resources introduced to the school has not been maximized in instruction.
- Teachers lack instructional strategies related to effective technology use in instruction.

- Teachers were not previously required to participate in consistent technology professional development to learn how best to use technology resources to enhance instruction.
- Teachers in the school most often use technology at the lowest levels of integration (substitution) according to the SAMR model (Puentedura, 2010)
- Teachers desire technology professional development.

Needs assessment findings indicate that despite the introduction of various technology resources at the study site, there was a pattern of consistently low and continuously declining student achievement from 2014 to 2016. Though investments were made in technology resources, teachers at the study site were not exposed to consistent professional development or other similar teacher development opportunities needed in order to acquire the knowledge and skills necessary to facilitate technology integration in instruction. The teachers lack instructional strategies related to effective technology use and as a result most often do not use technology or use it as a substitute for pencil and paper activities, for example notetaking. This implementation of technology falls under the lowest level of integration (substitution) according to the SAMR model (Puentedura, 2010). As such, the use of technology resources recently introduced to the teachers and the study site, including one-to-one laptops and smartboards, has not been maximized in student learning. The needs assessment also revealed that teachers desire technology professional development to enhance their use of technology for instructional purposes. This accumulation of evidence suggests that a proposed intervention should focus on supporting teachers in their development of knowledge and skills regarding effective instructional strategies that integrate technology at higher levels. The following literature review explores methods and strategies by which teacher development focused on effective technology integration for instructional purposes can be achieved.

Literature Review

Interventions focused on teacher development in relation to technology support, will be explored. These interventions have been implemented in efforts to improve teacher quality. Specifically, studies detailing focused collaborative professional development opportunities and mentorship programs for teachers are researched as avenues which enhance teachers' technology efficacy and may contribute to them increasing technology integration in their practice. These interventions focus on teacher development of effective instructional practices through professional development, mentoring programs, and enrollment in graduate level courses. Electronic searches were conducted using ERIC (1994 – 2016), JSTOR (2000 – 2016), PROQUEST (2000 – 2016), and Google Scholar (1950 – 2017). The search strategy included combinations of keywords for rural school environment (rural school environment OR positive school environment), teacher quality (rural teacher quality OR teacher efficacy OR teacher actions OR teacher development OR professional development OR professional learning communities), teacher development (teacher programs OR graduate courses for teacher development) technology integration (technology integration in education OR levels of technology integration OR effective technology integration), and teacher mentoring (teacher mentor programs OR mentoring teachers in rural areas OR mentoring).

In comparison to other geographical regions, there is relatively little research on small, rural schools (Arnold et al., 2005; Gandara et al., 2001; Hardré, 2008; Sherwood, 2000). Approximately only 6% of existing research on K-12 schools features samples from rural school settings (Hardré, 2008). As such, this review of literature also includes related research from other geographic regions with the intention of considering a wide selection of possibilities and solutions to address the needs of the rural study site. In particular, research in urban regions has been included as urban and rural school districts often face similar challenges (Abel & Sullivan, 1999; Burdick-Will & Logan, 2017; Truscott & Truscott, 2005).

Both urban and rural communities experience declining employment, increasing poverty, and shifting demographics within the population. Each of these factors affects school funding, often resulting in reduced budgets and teacher shortages, all while state and federal accountability continue to increase (Truscott & Truscott, 2005). Burdick-Will and Logan (2017) compared the educational characteristics and opportunities for students attending urban, suburban, and rural schools. These researchers identified school locations based on the boundaries of the districts that administer them and examined all public elementary schools in the United States in 2010-2011. Examining the make-up of schools along the rural-urban interface, the researchers highlight that there is a rather thin line that separates the two regions in terms of inequalities and challenges faced. Burdick-Will and Logan (2017) revealed that high free and reduced lunch levels, low funding, and low student achievement in urban and rural areas are quite similar and often result in common challenges and issues of inequality. As such, urban studies have also been included in this review where appropriate.

Teacher Quality

Research has long shown that teacher quality is an influential school factor which contributes to student achievement (Coleman et al., 1966; Lareau, 2012). The 1966 Coleman Report presented findings of a social science survey investigating equality of educational opportunity in the United States. Participants in this study included 600,000 students, 60,000 teachers, and 4,000 public schools across the nation. Family background and socioeconomic status were found to be primary factors which determined students' achievement outcomes; however, the quality of the teachers a student encounters while in school was also deemed noteworthy. Teacher quality matters; it is arguably the most important variable, at the school level, which influences student achievement (Coleman et al., 1966; Darling-Hammond, 2000c; Lareau, 2011; Rivkin, Hanushek, & Kain, 2005; Robinson, 2008).

Teacher quality is the most influential school factor affecting student achievement (Coleman et al., 1966; Lareau, 2011), and it represents an aspect of education which schools have the ability to influence. In other words, whether or not there is the community involvement, which previously discussed studies have noted as significantly beneficial, schools still possess the power to foster a positive and productive school environment by making efforts to shape teacher quality. Teacher quality is affected by teacher knowledge (Darling-Hammond, 2000a; Garet et al., 2001; Janssen & Lazonder (2015)) and beliefs (Rubie-Davies et al., 2011); making meaningful impacts on either of these factors is likely to affect teacher quality.

Teacher knowledge. Teacher knowledge has an impact on the levels of effective teaching and learning experienced in a school (Darling-Hammond, 2000a; Garet et al., 2001). What teachers know and how much they know are significant influences which help to determine the quality they bring to the profession. In the past, content knowledge and pedagogical knowledge were considered the two main components of teacher knowledge. However, the emergence of and dependence on technology in today's society results in the need for teacher knowledge to also include technology knowledge (Koehler et. al., 2011). Of further consequence, is teachers understanding the interactions among these three components of teacher knowledge (Koehler & Mishra, 2009; Mishra & Koehler, 2006). Effectively developing their technological pedagogical content knowledge (TPACK) is likely to result in improved teacher knowledge, thereby also improving teacher quality.

Technological pedagogical content knowledge. When it comes to selecting relevant teaching approaches and presenting content to their students, teachers need to understand technology's affordances and constraints (Harris et al., 2009). The Technological Pedagogical Content Knowledge model or TPACK (Koehler & Mishra, 2009; Mishra & Koehler, 2006) is an integrated framework which reflects the knowledge required of teachers for effective integration of technology. TPACK is an emergent form of knowledge based on the understanding of the interactions among content, pedagogy, and technology knowledge.

In order to be effective technology integrators, teachers should know more than the technical aspects of technology. Instead, they must understand the intricate connection among technology knowledge, content knowledge, and pedagogical knowledge. Teachers need training and support if they are to develop such an understanding. Janssen and Lazonder (2015) conducted a qualitative study to determine what TPACK-based support for a technology-infused lesson is preferred by pre-service and in-service teachers. Forty-six high school biology teachers (23 preservice and 23 in-service) were the participants in this study. The researchers presented a technology-infused lesson plan to the teachers. This lesson plan outlined a high school biology unit about glucose and insulin regulation by way of an inquiry-based approach to instruction using modelling software. The researchers further provided two types of technological, pedagogical, and content support in two support materials. Both types of support material provided the same elaborate technological information, but they differed in terms of the how the pedagogical and content information were presented. Referred to as integrated support by the researchers, the first type of support provided information to teachers on pedagogy and content in a compact and integrated manner, while the second type of support, referred to as separate support, provided three separate and elaborate sections about the content, pedagogy, and technology addressed in the lesson plan. Study participants were asked to evaluate both types of support materials, make an informed decision about their preference, and provide justification for their choice. The researchers collected data through semi-structured interviews with the teachers about their preferences for the support materials and reasons supporting their choices, and questions related to their opinions regarding the lesson plan and the support materials in general (Janssen & Lazonder, 2015). Based on the TPACK framework, researchers predicted that inservice teachers would prefer the integrated support material, while preservice teachers would prefer the extensive separate support material. Study findings indicate that the prediction for inservice teachers was an accurate one, and inservice teachers' justifications for their preference of the integrated support materials were consistent with the TPACK framework. However, the qualitative data did not present sufficient support to determine that preservice teachers preferred the extensive support material. The researchers found that preservice teachers were futureoriented and desired support that would help them "increase their proficiency rather than consolidate their existing knowledge base" (Janssen & Lazonder, 2015, p.910).

Teachers' levels of confidence regarding the different TPACK constructs is also likely to vary. For instance, some teachers may feel more confident in their technology knowledge (TK), while others may feel more confident in their technological content knowledge (TCK). Graham et al. (2009) investigated teachers' confidence related to four TPACK constructs: technological pedagogical knowledge (TPK), technological content knowledge (TCK), technological knowledge (TK), and technological pedagogical content knowledge (TPACK). Participants in this study included 15 (11 elementary and four secondary) in-service teachers who were also participants in a professional development program on science. Participants engaged in three phases of study: learning (content instruction); enacting (delivered lessons to students); and transfer (implemented in their own classrooms). The teachers were introduced to technologies including a range of geology animations, digital microscope, digital cameras, probeware, Google Earth, and GPS devices. According to the researchers, the teachers were less confident in their abilities to create media-rich materials or use technologies specifically tailored to teaching science (Graham et al., 2009). Researchers designed a 33 item pre-post questionnaire to measure teachers' confidence as it related to the four TPACK constructs previously mentioned. The data indicate that participants began and ended the study with the greatest level of confidence in their technological knowledge (TK), followed by technological pedagogical knowledge (TPK), technological pedagogical content knowledge (TPACK), and finally technological content knowledge (TCK). The researchers assert that these findings reinforce the idea that confidence in TK is foundational to develop confidence in the other three forms of TPACK knowledge measured. Another data finding highlighted that while only 47% of participants reported contentspecific instructional uses of technology on the pre-survey, 93% of participants reported contentspecific instructional use of technology on the post-survey. Data analysis also helped program coordinators realize that more can be done to assist classroom teachers develop TCK confidence by doing more to assist them in learning about content-specific technologies used for instruction.

Both studies discussed in this section note the importance of providing teachers with opportunities to develop their knowledge as it relates to effective technology integration in the classroom. Providing these opportunities to teachers can be accomplished through meaningful teacher development. Knowledge related to the successful use of instructional technologies has become widely recognized as an important aspect of a teacher's knowledge base in today's 21st century society (Graham et al., 2009). There is an urgent need for teacher professional development to focus on helping teachers remain current in their practice (Looi et al., 2008); if schools are to successfully prepare students to excel in the times in which they live, then it is necessary for their educational experiences to explore and effectively apply technology use for the purposes of teaching and learning. While students are in school, teachers should facilitate them having the opportunity to become more familiar with technology and its possible uses. Through effective technology integration, students have a better opportunity to develop autonomy and confidence (Tanveer, 2011), and experience success with learning. Integrating technology in their instructional strategies also gives teachers an avenue by which to meet the various learning needs of all the students they serve (Tanveer, 2011). However, technology skills alone are incapable of helping teachers to carry out their 21st century roles because one can understand how to operate a piece of technology without actually knowing how to use it effectively to enhance and promote student learning (Graham e al., 2009). An effective way to increase what teachers know about technology integration and enhance how they successfully impart this knowledge to their students is through effective professional development or teacher mentorship programs that focus on best practices in instructional approaches to teach content and 21st century skills, including technology integration.

Teacher beliefs. Unfortunately, teachers may have knowledge, yet choose not to use it to enhance the teaching and learning which takes place in their classrooms. Such incongruities arise as a result of teacher beliefs; what teachers believe influences how they think and the instructional decisions that they make (Rubie-Davies et. al., 2011). For instance, teacher beliefs about their own abilities can positively or negatively influence their practice. Teacher efficacy refers to a teacher's belief in his or her ability to carry out a specific task (Bandura, 1977; Holden & Rada, 2011). Teachers may perform poorly because they either do not have the ability or have the ability but do not have the perceived self-efficacy to make the best use of their knowledge or skills (Bandura, 1977; 2014). Interventions which seek to change or improve teacher efficacy in terms of technology integration have the potential to positively affect teacher quality.

Teachers' technology efficacy. Even though technology has changed how individuals, including teachers, go about their daily lives, it cannot be assumed that they automatically have the knowledge or efficacy to enhance their instruction by effectively integrating technology in their instruction. Teachers with low levels of technology efficacy are unlikely to integrate technology in their practices (Paraskeva, 2008). However, in a 2015 study, Adams found that introducing an instructional technology facilitator (ITF) in two rural North Carolina schools had positive effects on teachers' technology efficacy and willingness to integrate technology. This mixed methods study investigated the impact of the roles of the ITF on teacher efficacy in classroom technology integration in two rural public schools (one elementary school and one middle school). Sixty certified teachers participated in the study. The researcher gathered data using two surveys; the Computer Technology Integration (CTI) survey developed by Wang, Ertmer, and Newby (2004) which measured teachers' confidence levels in terms of integrating technology in the classroom and an ITF survey developed by the researcher. Additional data were gathered from 26 teacher interviews, where participants were randomly chosen from those who completed both the pre- and post-survey. Adams (2015) asserts that if teachers are to realize higher levels of technology efficacy, it is necessary for them to engage in specific learner centered support provided by a school-level ITF. Study findings indicate that teachers experienced enhanced levels of confidence in integrating technology when they knew that they had the full support of a school-level instructional technology facilitator. Teachers were also more inclined to attempt suggested technology integration strategies when they knew that the concepts they were learning could be immediately used to enhance their instruction. Teachers also reported that having an exact idea of when and how to use technology integrated strategies improved their efficacy (Adams, 2015). Improving teacher efficacy, specifically technology efficacy, is an ideal approach to improving teacher beliefs and the likelihood for effective technology integration. Teacher beliefs is a significant factor which helps to determine teacher quality, which in turn influences teacher actions.

Teacher Actions

Teachers' actions contribute to the school environment developed and fostered in schools (Hardré & Hennessey, 2013). Research shows that both teachers' non-instructional actions, such as their relationships with their students (Hardré, 2008; Hardré & Hennessey, 2013; Kiefer, Ellerbrock, & Alley, 2014) and instructional actions, for example use of technology (Graham, 2007; Hardiman, 2012) impact students' outcomes.

Non-instructional Actions. Teachers' non-instructional actions matter for student improvement; they can affect students positively or negatively and can prove to be just as effective as their instructional actions. The amount of time students spend with teachers readily facilitates the influence of teachers' non-instructional actions in their lives (Wentzel & Looney, 2007). According to Schoenfelder (2006), students spend more time with teachers than any other adult, sometimes including parents. As a result, value messages communicated by teachers help to shape the identity of youth (Hardré & Sullivan, 2008) because how teachers interact with their students, and the characteristics they nurture has an effect on students' motivation and attitudes towards student achievement. In fact, effective teachers are usually noted as those who take time away from instructional actions to foster community and caring in their classrooms; they create emotionally close, safe, and trusting relationships with their students (Wentzel, 2010). Research conducted by Kiefer et. al. (2015) note the importance of positive student-teacher relationships in an urban school setting. In a descriptive qualitative study, Kiefer et al. (2014) investigated the ways urban middle school teachers supported young adolescents' academic motivation. Data gathered in this study included 24 individual interviews of participants. The sample group consisted of 18 students, five teachers, and one middle school assistant principal. Findings from this study suggest that students' motivation to do well in school is likely supported by teacherstudent relationships, teacher expectations, and instructional practices responsive to students' basic and developmental needs. According to Kiefer et al. (2014), the potential for educators to meet the needs of their students and provide strong support may be maximized when such expectations and instructional practices are implemented within the context of high-quality teacher-student relationships.

A key element of rural students' learning needs is the need for teacher support (Hardré & Hennessey, 2013). Hardré and Hennessey's (2013) rural research produced similar findings to Kiefer et al.'s (2014) urban study. Students tend to perform at higher academic standards when supported and motivated by their teachers (Hardré & Hennessey, 2013; Kiefer et al., 2014). In a 2013 study, Hardré and Hennessey investigated how rural high school teacher beliefs and perceptions of themselves, their students, and the challenge of motivation influence their classrooms. The study sample consisted of 13 high school teachers in three rural public high schools across two U.S. states. The researchers employed a mixed-methods approach to examine non-instructional actions, such as motivational beliefs, perceptions, and strategic actions among high school teachers in rural environments. In responses to motivational open-ended questions created by the researchers, study findings note that student motivation is malleable; it can be molded and shaped by teachers. Students with higher levels of motivation are more likely to do better academically, than students who lack motivation (Hardré & Hennessey, 2013). Teachers involved in the study also shared that they felt capable of adjusting students' lack of motivation when they are able to identify the causes of such (Hardré, 2008; Hardré & Hennessey, 2013).

Students themselves have also identified the potential impacts of teachers' noninstructional actions. Williams, Sullivan, and Kohn (2012) investigated teacher effectiveness according to the opinions of students. Pre-service teachers and graduate students enrolled in a classroom management course wrote letters to secondary students in efforts to gather information regarding the traits of an outstanding teacher. In their letters to the secondary students, the university students shared their interests, the subjects they desired to teach, then asked a number of questions. While their professor provided sample questions, the university students were free to include additional questions of their choice as long as they solicited no personal details such at contact information from the secondary students. Typical questions included: "What makes an outstanding teacher? Have you considered teaching as a career? and What do you want to be?" (Williams et al., 2012). Responses to the letters were gathered from 223 students in grades 7-12 from four secondary schools. Participants attended a private Christian academy in an affluent suburban area (*n* = 95), a rural high school in a low socioeconomic community (*n* = 56), a rural middle school in a low socioeconomic community (*n* = 35), and a large high school in a heterogeneous middle class suburban area (*n* = 37). Findings of this study revealed that whether students lived in affluent suburban neighborhoods or poor rural settings, students had similar opinions regarding the characteristics of an outstanding teacher. The top three teacher characteristics mentioned by the students were a caring attitude, knowledge of subject and how to teach it, and classroom management skills. The students emphasized that they desired teachers to "connect with kids by caring about them" to "actually listen to what a student has to say" and to teach "for the mere satisfaction of making a difference in at least one student's life" (Williams et al., 2012, p. 111).

Instructional actions. Teachers' instructional actions have a direct impact on the education that students receive. The instructional strategies that teachers use often influence levels of instructional rigor, student interest, and student understanding (Pierce, 2016). To encourage student learning and higher levels of student achievement, teachers must select rigorous and engaging instructional strategies and present them to students in a manner that they can understand (Newton & Newton, 2014; Pierce, 2016). In addition, today's teachers face the additional responsibility of preparing their students for a technology-driven future that is quite different from the past and even the present (Looi et al., 2008; Zavadsky, 2016). While educational approaches have largely remained the same over the last five decades, workforce and societal needs have significantly changed (Zavadsky, 2016). Teachers' instructional strategies must transform in ways that prepare students for success in school, and also equip them for success in their technologically driven society, beyond school years.

The 21st century is technologically driven, and various technological devices have become vital to the way business is conducted and the way individuals go about their daily lives (Keengwe et al., 2012; Liu et al., 2014; Okojie, 2011). The rapid technological changes have resulted in today's students being technologically savvy, and it is difficult for teachers to engage these sophisticated learners with simplistic strategies and pedagogy (K-12 Superintendents Working Group, 2016; Looi, 2008). Ideally, educators should ensure that today's educational opportunities reflect 21st century changes by effectively integrating technology-use in their schools (Looi et al., 2008; Maninger, 2006). In fact, technology integration should be considered as the mandatory use of critical tools for teaching and learning, not an optional add-on (K-12 Superintendents Working Group, 2016).

Technology integration

Hardiman (2012) asserts that in order for students to receive instruction consistent with the skills required in the 21st century society in which they live, teachers' instructional habits must change. Teachers should give students multiple opportunities to be inventive and to apply knowledge in a variety of ways which add to the development and nurturing of creative minds. Expanding lessons to include activities which require the integration of technology (Irving, 2009; Keengwe et al., 2012; Shieh, 2012) is an effective instructional strategy which facilitates teachers creating opportunities for students to receive instruction connected with the development of 21st century skills. Employing these strategies are likely to help teachers increase levels of student motivation and engagement in their classrooms. These mediating variables significantly contribute to teachers being able to realize increases in student achievement, which is the ultimate goal (Hardre, 2008; Hardre & Hennessey, 2013; Kiefer et al., 2014).

When technology is integrated effectively, there are benefits for student learning (Gee, 2005; Okojie, 2011; Squire, 2005). In a 2012 study, Keengwe et al. investigated how a one-toone laptop initiative affected learning in a rural, Midwestern high school. Conducted during the 2008-2009 school year, the study included 13 teachers and 105 students enrolled in grades 10 through 12. Researchers relied on a modified survey instrument created by the Mitchell Institute (Mitchell Institute, 2012). This survey collected data on student and faculty perceptions of the impact of the one-to-one on student learning and instructional integration of technology in education. Using descriptive analysis of test scores for 2008 and 2009, student grade point averages, and survey data of participating and non-participating students, researchers provided evidence which indicated that this technology initiative positively affected students' academic engagement in the classroom. For example, students' participation in lesson activities increased. Teachers were also surveyed. Findings from the data gathered for this study substantiate the fact that a 1:1 laptop program can positively boost student learning as measured by end of year tests and overall GPAs. Of the teachers surveyed, 77% reported that students' engagement and interest levels improved as a result of laptop integration; 77% reported that students' ability to work independently also improved; 69% reported that student motivation also improved. All teachers surveyed (100%) reported that laptop integration had no effect on student attendance; 77% reported that laptop integration had no effect on student behavior or students' abilities to work in groups. In terms of at-risk or low achieving students, 83% of teachers reported that there was improved engagement and interest levels in learning as a result of laptop integration; 75% of teachers said that student motivation for this group had improved. Laptop integration also had positive effects on high achieving students; 90% of teachers reported that there was an improved level of engagement and interest by these students. In addition, 80% of teachers reported that high achieving students also showed improved levels of motivation for achievement and learning; 70% of teachers also perceived that high achieving students reflected an improved ability to work independently as a result of the laptop integration program. However, researchers highlight that collaborating with students to understand various instructional technology applications is noted as a necessary task for teachers if they are to go beyond the basic uses of technology (Internet browsing and word processing) in instructional activities. The researchers assert that there is a need for teachers to employ appropriate strategies for technology integration in order to truly enhance its effect on teaching and learning (Keengwe et al., 2012).

Using technology, students are able to view content in various forms as it comes alive with videos, maps, and hyperlinks to additional information (Darling-Hammond, Zielezinski, & Goldman, 2014). Creating a learning experience that embraces and encourages this involvement is beneficial as students can and have easily become comfortable working simultaneously with multiple sources of information communication technologies (ICTs) such as blogging, using search engines, portable digital assistants (PDAs), and instant messaging (Looi et al., 2008). In a 2006 study, Maninger investigated whether a technology-rich environment created in a high school English classroom would make an impact on students' pass rate on state-mandated reading tests. Set in a suburban area, the study included eight English I classes taught by the same teacher. There were 185 student participants, 110 of whom were considered at-risk. For the purpose of the study, at-risk was defined as students who had been retained, had already become parents or were soon to be parents, had previously dropped out of school, were homeless or in the custody of the Department of Protective and Regulatory Services, had limited English proficiency, or had serious behavioral issues previously addressed by the school (Maninger, 2006). Each student had a laptop, and the teacher stated that "some form of technology was used every day" (Maninger, 2006, p. 43); as a result, students were kept actively engaged in content. Analyzing data from various sources, including students' scores on the state-mandated reading test, teacher interviews, and classroom observations of instruction, study findings assert that maintaining a technology-rich environment appeals to, stimulates, and motivates at-risk high school students to achieve success on state-mandated tests.

When teachers' instructional actions include effective technology integration in instructional activities, there are positive results for student learning and performance (Maninger, 2006; Rakes et al., 2006). Rakes et al. (2006) investigated the relationship between technology use and skills and the use of constructivist instructional practices among teachers in rural schools. Participants in the study included a total of 123 teachers from 36 elementary schools, 17 middle/junior high schools, and 13 high schools. Education technology resources and professional development were provided to the teachers for a year before survey data were collected. The teachers in the study provided responses to a 50-item survey, the Levels of Technology Implementation (LoTi) (Moersch, 1995). The survey data were gathered to determine whether teachers' levels of classroom technology use and personal computer use predicted the instructional practices that they employed. The survey instrument was used to create a profile for each respondent according to three domains: Level of Technology Implementation (LoTi), Personal Computer Use (PCU), and Current Instructional Practices (CIP). This LoTi scale measured authentic technology use in seven categories, the Personal Computer Use scale measured the skill and comfort level of teachers when using technology for personal use based on eight levels of intensity, and the Current Instructional Practices scale measured teachers' current classroom practices also based on eight levels of intensity (Rakes et al., 2006). Study findings illustrate that there is a positive relationship for teachers and students stemming from increases in personal computer use and levels of technology use for instruction in the rural classroom. Specifically, there was a significant positive relationship between both levels of personal computer use and classroom technology use and the use of constructivist instructional practices, where personal computer use was the strongest predictor (Rakes et al., 2006). However, the researchers note that no classroom observations were conducted; this can be considered a limitation of this study as measures were derived from data gathered solely using the survey the researchers created based on technology implementation as outlined by the LoTi framework (Moersch, 1995). Providing information from 153 teachers across 11 districts, this study highlights the importance of incorporating technology use in instructional strategies; however, in addition to conducting classroom observations, the study could have been strengthened had researchers indicated how technology was actually used and the frequency of use.

The technological demands of the 21st century require that teachers integrate technology to enhance teaching and learning. But simply using technology in classrooms is not enough to realize progress (Cifuentes et al, 2011; Keengwe et al., 2012). Technology-driven instruction is demanding and complicated, unlike the traditional classroom instruction (Okojie, 2011). Teachers' roles have shifted from simple to complex; now they are expected to keep up with information brought about by the transformational 21st century changes in knowledge production. Today, teaching takes place in a technology-driven environment and requires that teachers are able to engage students in various aspects of pedagogical practice, in order to address technology influenced changes in the wider society (Okojie, 2011). To serve as efficient technology facilitators, teachers need the training and support to develop technology knowledge and learn how technology is useful in facilitating successful teaching and learning in their specific content areas. Teachers must be trained in how best to use technology in order to enhance instruction and motivate students (Keengwe et al., 2012). Successfully integrating technology requires that teachers take on multiple new or evolving roles which include instructional methods specialists, change agents, mentors, technology integration specialists, instructional technology researchers, lifelong learners, and specialists in setting the stage for learning (Okojie, 2011). To become efficient technology educators, teachers must be provided with opportunities to increase their technological pedagogical content knowledge (TPACK) and implement best practices for technology integration.

Teacher Development

Unfortunately, the needs of rural schools do not dictate the quality of either traditional or alternative certification teacher preparation programs or the policies which govern them. However, rural schools have the power to positively influence their school environments by providing their teachers with meaningful opportunities for growth. Research indicates that there are various school and student benefits to be gained by investing in teacher development in the form of professional development, mentor programs, and graduate coursework.

Professional development. Research indicates that the benefits of investing in highquality professional development outweigh the costs (Darling-Hammond, 2000c; Garet et al., 2001; Guskey & Yoon, 2009; Robinson, 2008). These benefits are evident in the fact that highlyqualified, expert teachers usually have higher rates of student achievement. The reality is that rural teachers must be experts or emerging experts if they are to be relevant and successful in today's society; that is, they ought to be well-versed in acknowledging and employing best policies and practices in teaching their content along with 21st century skills, such as effective technology integration (Darling-Hammond & Richardson, 2009; Voogt et al., 2013). An effective way to increase what teachers know and enhance how they successfully impart this knowledge to their students is through effective professional development that focuses on technology integrated best practices in instructional approaches to teach content and 21st century skills. Furthermore, no improvement effort in education has ever been successful without wellplanned and well- implemented professional development (Guskey & Yoon, 2009); professional learning is necessary for teachers to improve their practice. Applicable professional development is necessary if teachers are to be successful in technology integration to enhance their instructional actions. Teachers will directly benefit from focused professional learning

(Guskey & Yoon, 2009; Robinson, 2008), and students will benefit indirectly (Robinson, 2008) by having access to improved teaching aligned to current research-based best practices in education.

Targeted professional development is ideal for training in-service teachers in how best to serve their students (Guskey, 2002; Guskey, 2009); it consists of any activities that directly affect the attitudes, collaboration, content knowledge, skills, and practices of teachers and is likely to help them perform their roles well (Robbins & Alvy, 2009). In fact, professional development has the power to improve teacher's effectiveness in the classroom (Porter et al., 2000). Through meaningful training sessions and workshops, teachers can improve their instructional expertise and increase their content knowledge.

The instructional expertise of teachers and their content knowledge (Darling-Hammond, 2000b; Garet et al., 2001) are definitely important for 21st century learning (Looi et al., 2008). Teachers who work at improving their craft are likely to demonstrate positive influences on student achievement as they spend time exploring how best to engage students in learning. In a 2001 study, Garet et al. provided a large-scale empirical comparison of the effects of different characteristics of professional development on teaching. The study sample included 1,027 mathematics and science elementary and secondary teachers. Data were drawn from a Teacher Activity Survey conducted as part of the evaluation of the federal Eisenhower Professional Development Program. This program was geared toward improving the knowledge and skills of classroom teachers through professional development. According to the research, sustained and intensive professional development focused on developing the skills and content knowledge of classroom teachers has a positive impact on teacher quality and subsequently student achievement. Findings of this study identify two categories of professional development features which have great potential for achieving results: structural features and core features. Six factors of effective professional development were identified within these categories. In order to be effective, professional development must be structured in its form (for example: study group, teacher network), participation (for example: groups of teachers from the same school, grade level teams, departments), and duration (length of individual sessions and time span for all sessions). Research shows that between 20 and 80 hours of instruction, practice, and coaching are required for professional development programs to be effective and facilitate teachers reaching mastery (Banilower, 2002; Ingvarson, Meier, & Beavis, 2005; Gulamhussein, 2013; Yoon et al., 2007). Additionally, researchers identified three core features of effective professional development: content focus, active learning, and coherence with other learning (encourages continued professional communication among teachers, aligned with standards and assessments, and consistent with teachers' goals). The structural characteristics of professional development programs impact the core features of these programs (Garet et al., 2001). In turn, core features influence the successfulness of professional development in increasing teachers' self-reported growth in knowledge and skills and the resultant changes in teaching practice.

In terms of teacher practices and the resultant learner outcomes, professional development which focuses on student learning and helps teachers develop the pedagogical skills to teach specific content has strong positive effects on practice (Darling-Hammond & McLaughlin, 1995). Desimone et al. (2002) examined the effects of professional development on teachers' instruction in mathematics and science from 1996 – 1999. The study gathered data from a purposefully selected sample of 207 elementary, middle, and high school teachers, representative of 10 schools, in 10 school districts across five states. The study looked at features of teachers' professional development and their effect on enhancing teacher practice in the two subject areas named. Teachers were surveyed on three occasions over a period of three consecutive years: 1997, 1998, and 1999. The researchers conducted data analysis and sought to explain teaching practices observed in Year 3, based on teachers' professional development in Year 2, and controlling for teachers' classroom teaching practices in Year 1. Findings of this study confirm that professional development which was focused on specific instructional practices increased teachers' use of said practices in their classrooms. The researchers also found evidence which suggest that specific features of professional development, for example active learning opportunities, increased the effect of the professional development on teachers' instruction. According to Desimone et al. (2002), active learning opportunities facilitate teachers regularly interacting with their colleagues to discuss student learning.

High-quality professional development helps to ensure that teachers are engaged in relevant and meaningful activities designed to continue their learning. The research implies that such opportunities are a viable means by which to improve teachers' instructional practices (Darling-Hammond & McLaughlin, 1995; Desimone et al., 2002). In today's climate of reform, professional development can facilitate and encourage teachers rethinking their own practice and enhance their abilities to teach in ways that they have never contemplated before (DarlingHammond & McLaughlin, 1995). To help students become 21st century learners and improve 21st century skills, teachers must learn to teach in ways that integrate technology and develop skills such as higher-order thinking (Darling-Hammond & Richardson, 2009).

Advances in technology have already begun to transform the American classroom (Cifuentes et al., 2011; Irving, 2006; Maninger, 2006), but there are still many questions about how effective this integration has actually been for student learning (Darling-Hammond et al., 2014; Zhao & Frank, 2003; Zheng et al., 2016). Researchers argue that the key to successful technology integration lies within the improvement of teachers' abilities to employ technology in a manner that results in academic gains for students (Cifuentes et al., 2011). Therefore, rural schools have the power to positively influence their school environments by providing their teachers with meaningful opportunities for growth in this area. Teaching in a technologicallydriven environment demands teachers who have the ability to engage students in all aspects of teaching practices to address changes in wider society (Okojie, 2011). Investing in teacher growth is important if schools expect to effectively integrate technology use (Okojie, 2011). Cifuentes et al. (2011) describe the STAR Project which focused on efforts to develop a learning community specifically aimed at supporting technology integration in three south central, rural school districts. Study participants included 35 teachers, nine administrators, two university faculty members, one university graduate student in educational technology, and three school technology specialists. Nine teachers taught at the elementary level, while 26 of them taught at the secondary level. This learning community engaged in technology integration training activities and collaboration over a two-year period. Classroom observations, the Stages of Adoption Inventory (Christensen, 2002), a Teacher Technology Use Questionnaire (Cifuentes et. al., 2011), and evaluation surveys (Cifuentes et al., 2011) were used to gather data. Each data source provided insights regarding the elements of the learning community which contributed to teachers' abilities to integrate technology (Cifuentes et al., 2011). Findings revealed that strategies applied in the STAR learning community encouraged teachers' use of effective technology integration in classroom teaching and learning. These strategies featured the implementation of quality technology implementation professional development for teachers in a shared learning community, polling instructors and administrators and discussing their interests and capabilities in order to make appropriate technology implementation decisions, teaching and learning tours (classroom observations) focused on student engagement, teachers sharing insights relating to addressing implementing issues, sharing coaches and mentors who met regularly to devise solutions to technology problems, and building an interactive website for teachers to share materials, lessons, and reflections. The data highlighted that teachers' enthusiasm and comfort for technology integration in their teaching increased over the two years of professional development. Cifuentes et al. (2011) assert that strategies applied in the shared learning community encourage effective technology integration in classrooms.

Various approaches to professional development can potentially result in teacher and school improvement; however, Chance and Segura (2009) assert that teachers' instructional improvement and overall school improvement strategies focused on collaboration are the most beneficial. In this case study, researchers presented data regarding a rural high school which improved and sustained student achievement. The study site has shown significant improvement and sustained student achievement for a period of three years. According to the study, the school realized and maintained improvement in test scores, attendance and graduation rates, as well as, achievement of Adequate Yearly Progress (AYP). Change and Segura (2009) investigated the circumstances by which this rural school was able to move from one of low achievement to one of sustained high achievement. The researchers set out to investigate a rural high school that had "purposively developed a plan for school improvement and sustained its efforts" (Change & Segura, 2009, p. 2). Data for this study were collected from various sources including sixteen individuals who took part in the school improvement process. These individuals included the superintendent of the school district, the school's principal at the time of the study, two parents, ten teachers, and two students. The researchers also gathered information from school improvement documents such as memos, yearly accreditation reports, newsletters, and the actual school improvement plan. In addition, the researchers conducted observations and gathered further data from classrooms, staff meetings, and collaborative planning meetings for faculty. Chance and Segura (2009) found that a specific process of collaboration was the driving force for the rural school's sustained improvement. In particular, three principles of collaboration were strictly observed at the rural school: 1) there was a scheduled time for teacher collaboration; 2) collaboration among planning groups was structured and focused; and 3) school leadership ensured that planning was student-centered and that teachers and administrators were held accountable for their actions. The researchers highlight that, "Teachers overwhelmingly reported the importance of the collaborative time to complete tasks as a staff" (Chance & Segura, 2009, p. 7). Working collaboratively, school decisions were made by consensus, which fostered the development of a common vision of curriculum and instruction. Also, organizational features of teachers' collaboration included time, focus, and structure. Time for teacher learning was prioritized and set aside. This time was structured by the school's principal who identified specific goals and objectives to be accomplished during each collaborative session. Teachers were provided with an agenda at each collaborative meeting, and they were held accountable for addressing all tasks listed. Chance and Segura (2009) noted that collaboration time was focused on efforts which facilitated instructional effectiveness. This rural school was able to attain and sustain school improvement by requiring its teachers to work collaboratively in a professional learning community.

Professional learning communities. Professional development in the form of collaborative professional learning communities (PLCs) is a significant way to improve teacher quality and effectiveness (Chance & Segura, 2009; Muirhead, 2009). The PLC framework is often implemented by schools as a method to effectively realize school improvement (Dufour,

Dufour, & Eaker, 2010; Kobett, 2016). The success of PLCs is dependent on strong visionary leadership to develop a school culture that cultivates and sustains effective efforts which are driven by results (Blankenship & Ruona, 2007; Kobett, 2016). This framework facilitates teachers' consistent and focused collaboration to improve the success of teaching and learning. Teachers have the opportunity to improve their craft when their teaching is connected to other faculty members in their school (Lowe, 2006), and the formation of PLCs helps to create and foster these connections. As a result, professional learning communities can change practice and transform student learning; these changes are especially feasible when processes and structures that encourage collaboration are in place and are desirable (Chance & Segura, 2009; DarlingHammond & Richardson, 2009). In the PLC model, teachers work collaboratively and participate in continuous communication to examine their practice, develop and implement more effective instructional strategies, and evaluate student performance. Researchers have identified five features of PLCS; they are (a) supportive and shared leadership, (b) collective and applied learning, (c) shared personal practice, (d) shared value and vision, and (d) supportive conditions (Hord, 2004; Kobett, 2016; Morrissey, 2000).

Professional learning communities support collaboration. In a 2010 study, Levine and Marcus investigated types of collaboration most likely to improve what high school teachers and students learn. The study focused on different collaborative activities carried out by one teacher team in a major metropolitan area. Participants included seven educators that included: five teachers, one resource specialist, and one principal at a school welcoming its first group of ninth graders. Primary data including field notes from 37 collaborative meetings and documents collected during teachers' collaborative work point to significant findings. Data were analyzed through a socio-cultural theoretical framework to suggest how the structure and focus of collaborative activity can impact how frequently teachers discuss their teaching, which aspects of schooling collaboration addresses, and what opportunities for teacher learning are afforded or constrained. Criteria were developed for sampling three different types of meetings: stronglystructured, protocol-guided, and loosely structured. Findings illustrate that decisions regarding the structure and focus of teachers' collaborative activities can either facilitate or constrain what teachers learn together. Deliberately structuring and focusing teachers' collaborative training can improve its impact on schooling (Levine & Marcus, 2010).

Teachers' professional development facilitated through the creation of professional learning communities (PLCs) yields positive results for student achievement (Love, 2009; Levine & Marcus, 2010; Muirhead, 2009; Vescio, Ross, & Adams, 2008). According to Graham (2007), same subject and same grade teacher teams have the potential to realize significant improvements in teacher effectiveness through participation in PLCs. Referencing core academic data gathered from 15 middle school teachers in a professional development survey, Graham (2007) conducted a mixed methods case study investigating the relationship between teacher improvement in effective instructional strategies and professional learning community activities. Findings indicate that while having the potential to improve teacher effectiveness, the impact of professional learning communities also depends on a number of significant factors. These factors include leadership and organizational practices, the nature of conversations in professional learning community activities, substantive details of professional learning community activity meetings, and the development of community among professional development teams – that is, team members productively communicating and collaborating. In order for professional learning communities to lead to teacher improvement, they must be structured in terms of the focus of the training, its activities, and time, and have committed teacher members trusting each other and working together (Chance & Segura, 2009; Graham, 2007).

Working in professional learning communities, teachers become familiar with more effective instructional strategies to employ in their classrooms. They can collaborate to create engaging lessons and share what works and what does not work when teaching various concepts. PLCs easily facilitate teachers' learning about changes in education and how best to address these changes. In today's 21st century society, the opportunity for this continued learning is very important for teachers as there have been various changes in the skills necessary for progress and success in school and the wider society (Darling-Hammond, 2008; Southern Regional Education Board, 2014). Changes include a decrease in the demand for a workforce that merely possesses basic skills and an increase in the demand for workers who are equipped with more complex skills including effective technology use; twenty-first century skill sets emphasize proficiency in independent thinking, decision making, and problem solving (Silva, 2009).

Developing students' cognitive and academic skills and preparing them to meet the new demands requires that teachers employ instructional strategies and activities which encourage and support creative and innovative thinking (Hardiman, 2012). Professional development, including professional learning communities, provide critical opportunities to improve teacher quality by expanding teacher knowledge and enhancing their effectiveness in teaching and learning. Providing collaborative professional development opportunities for teachers is essential. A second form of learning communities considered as an effective professional development opportunity are communities of practice (CoPs) (Goldstein & Butler, 2010; Wenger, 2007; 2011).

Communities of practice. Communities of practice are created by individuals who engage in a process of collective learning; they share a passion or concern for something they do and learn how to do better as they interact and collaborate on a regular basis (Abigail, 2016; Wenger, 2011). The size of CoPs varies, and they can be formal or informal. According to Wenger (2011), nine activities typically characterize this form of learning community, a) problem solving, b) requests for information, c) seeking experience, d) reusing assets, e) coordination and synergy, f) discussing developments, g) documentation of projects, h) visits, and, i) mapping knowledge and identifying gaps. Though considered similar to PLCs in terms of having a collective vision, shared practice, and being inquiring driven (Hord, 2004; Kobett, 2016), three distinct elements distinguish CoPs: domain, community, and practice (Abigail, 2016; Wenger, 2007). Domain determines common ground for knowledge sharing; community creates the social structure for interaction, and practice relates to specific knowledge that is maintained and shared by the community (Abigail, 2016). In addition, CoPs consist of voluntary members, and knowledge is founded in situated cognition as it is socially constructed, accessed, and shared within in the community (Kobett, 2016; Lave & Wenger, 1991), while PLC members are assigned, data-driven decision-making drives the work being done (Dufour, Dufour & Eaker, 2010), and teams create new knowledge to realize desired results (Kobett, 2016). In CoPs, as members look for information in their domain, they participate in common discussions as well as activities that build and strengthen community relationships which support learning (Kobett, 2016).

An example reflecting the benefits of a communities of practice learning group is evidenced in a 2014 study by Drouin, Vartanian, and Birk. These researchers investigated the effectiveness of the CoP model for introducing tablets to 139 faculty members at an institution of higher education. Four full cohort meetings for all study participants were conducted. These meetings were focused on specific topics of interest indicated by the participants reported through bi-weekly surveys. In addition, faculty members were required to attend at least three to four small group meetings. These meetings emphasized CoP culture and faculty members helped each other in learning how to use the devices they had been provided. Meeting discussions focused on the opportunities and challenges that these devices presented in regards to teaching, research, and service (Drouin et al., 2014). The researchers developed various methods by which faculty could share information about their experiences using the technology. There were a series of faculty led demonstrations, round-table discussion, and workshops focused on using the device. Three surveys were administered at the beginning, middle, and end of the semester long project. Surveys one and three measured motivations and experiences in terms of teaching with technology and social or collaborative interactions. The second survey was brief and featured questions about the amount of time participants had used their tablets outside of the classroom and how they were using them. The researchers stated that because the responses from the second survey were mostly qualitative and response rates were low, only data from surveys one and three were used to determine study findings which support the use of CoP models for the successful integration of technology within higher education.

The success of the communities of practice model is also evident in the public school system. Positive results for incorporating the CoP model have also been noted by Lotter, Yow, and Peters (2014) who investigated the impact of teaming school-based instructional coaches with science or mathematics middle school teachers to build a CoP around inquiry instruction. Participants in this study included 39 middle teachers and 12 coaches. Participants took part in a two week summer institute and four follow-up sessions during the academic school year. These sessions focused on, a) content instruction, b) practice teaching to middle schoolers, and c) reflections led by coaches. Seven data collection methods were used including 1) a pre-institute questionnaire, 2) a pre-institute inquiry lesson (recorded by teachers), 3) daily reflections on practice teaching lessons, 4) final reflection paper completed following the summer institute, 5) a post-institute questionnaire, 6) an end of year questionnaire, and 7) a post institute inquiry lesson (recorded by teachers). Researchers analyzed the inquiry lessons using the Reformed Teacher Observation Protocol (RTOP) (Sawada et al., 2002). Findings of this study highlight that employing the CoP model resulted in teachers improving their understanding of inquiry-based practices and the quality of their classroom inquiry implementation. Teachers reported that CoP participation introduced them to new instructional strategies and allowed them to engage in content instruction as students, which was greatly beneficial.

Participation in learning communities provides opportunities for teacher development (Drouin et al., 2013; Kobett, 2016; Wenger, 2011). When implemented in a meaningful and productive manner, teachers benefit from the opportunities to engage with other teachers for collaboration while also reflecting on their own teaching practices. An alternative to professional learning communities are mentor programs, which can provide teachers with similar opportunities for effective development. Schools have successfully implemented mentor programs to improve teacher and overall school quality.

Mentor programs. In terms of cost, mentoring is an inexpensive approach to teachers' professional development which enhances traditional approaches to staff development and promotes team-building among staff participants (May, 2000). On the other hand, this method of staff development requires a significant investment in terms of time; however, both pre-service and in-service teachers have the potential to benefit from this approach to teacher improvement

(Hansen-Thomas & Richins, 2015; Oigara & Wallace, 2012). Mentors experience an increased feeling of self-worth, while mentees experience an increase in self-confidence (May, 2000). The teacher quality of both groups of participants can be improved.

The benefits of effective mentor programs stretch far and wide (May, 2000; Oigara & Wallace, 2012; Zhao & Bryant, 2006). May (2000) conducted a study specifically targeted at educational improvement through technology integration. The study emerged as a grant intended to funnel funds into rural schools for effective technology integration. Teacher groups from three rural schools participated in the study. Both quantitative and qualitative data were collected through classroom observations, interviews, anecdotal notes collected by the technology facilitator, and teachers' Profiler scores. Profiler scores were drawn from a standardized online survey created by the South Central Regional Technology in Education Consortium (SCRTEC). The survey consisted of 30 questions which assessed teachers' personal confidence in technology skill and application; teachers responded to the survey before and after participating in the study. Researchers made comparisons between an on-site mentoring format and a traditional approach to staff development. Forming two groups, researchers highlighted that the traditional format for professional development in this study had participants to take part in two day sessions of hands on whole group technology instruction; participants did not have access to a mentor to facilitate small group discussions or to provide additional support and feedback. On the other hand, the mentoring approach had teachers participate in onsite mentoring activities which included the development of technology integrated classroom projects with collaborative support provided by mentors. One group functioned as the control group (traditional approach to staff development), while the other group received the treatment (mentoring format). "In each team, the member who felt more comfortable with technology skills was designated a mentor" (May, 2000, p. 277). Data revealed that all teachers who participated in the mentoring activities had an increase in Profiler survey scores indicating that self-reported confidence of technology skills ability increased. Mentoring activities in this study included collaboration, feedback, and support for teachers while they were using technology. When teachers' mentoring and traditional staff development scores were compared, data revealed that teachers participating in the mentoring approach experienced gains in scores which were 21 percent higher than the gains reported by teachers who participated in the traditional staff development approach. May (2000) found that while traditional staff development also proved beneficial, a mentoring approach greatly enhanced the effectiveness of training to improve technology integration. These findings assert that the previously mentioned mentoring activities had positive influences on various factors which impact teacher quality, and the teachers revealed that having a mentor/colleague with whom to collaborate increased their ability to work through various technical issues (May, 2000). Other findings noted that mentoring positively influenced school climate, staff development effectiveness, teachers' technology confidence, and overall technology integration by the participants.

While some school districts and individual schools invest in initial technology integration training for teachers, continued support is lacking and often contributes to limited technology integration, even when technologies are available. On the other hand, research shows that technology training followed by embedded technology mentoring opportunities is likely to increase effective technology use for teachers. Zhao and Bryant (2006) conducted a study investigating the impact of state mandated technology integration on classroom teachers by analyzing two qualitative data sets. Participants in this study included only individuals who had successfully completed a statewide curriculum-based technology integration training through staff development. The training was a 50-hour semester-long training which was designed to prepare K-12 teachers with the necessary technology skills to: 1) incorporate technology in curriculum standards; 2) use various technological resources; 3) integrate these resources in new designs for teaching and learning; 4) create effective strategies for classroom management; and 5) develop a new and enhanced pedagogy with technology (Zhao & Bryant, 2002).

The first dataset consisted of 17 middle and high school social studies teachers; researchers focused on post-training teacher technology integration levels. Teachers came from six different school districts which were located in mostly rural and suburban regions. The teachers involved in the study represented schools which ranged from being technology rich (high access and use of technology) to technology poor (low access and use of technology). The second dataset consisted of five general education elementary school teachers, from the same school, who each had class sizes of 14 to 25 students. All schools (both datasets) had technical human resource support available to teachers. The first dataset did not participate in any followup technology training, while all teachers in the second dataset were supported by a technology integration specialist who served as a one-on-one mentor after InTech training. Data were gathered from surveys, open-ended interviews, classroom observations, and document analysis (reflection journals, lesson plans, instructional web pages, handouts, and students' technologybased projects). Findings of the study revealed that technology training had different impacts on novice technology users, experienced technology users, and new teachers. While some teachers developed positive attitudes and new insights for teaching with technology, others were overwhelmed by the amount of information they were expected to digest in a limited time frame (Zhao & Bryant, 2006). Novice teachers viewed the technology training as an enlightening experience; before their participation, they were limited users of technology in their classrooms and lacked computer skills. Novice teachers also feared failure when it came to effective technology integration and were therefore unwilling to try; however, as a result of their participation in the technology training, novice teachers became more comfortable using technology for instructional purposes. The more experienced teachers shared that their participation allowed them the opportunity to learn about new ideas and new ways of integrating technology. The more experienced technology users reported that they learned how to use different programs and how they could actually incorporate them in their lessons. According to this group, participation enabled them to design technology-related lessons which were meaningful and enjoyable to students. Interestingly new teachers who participated in Zhao and Bryant's (2006) study revealed that they felt frustrated and believed that technology training would be more beneficial for veteran teachers. New teachers said that they felt unprepared and uncomfortable when it came to using what they had learned in the professional development while also trying to get familiar with teaching their content. They shared that they were overwhelmed with too many software programs, too much information, and limited time (Zhao & Bryant, 2006). These data imply that new teachers enter the teaching profession may be unprepared to completely fulfill their roles as teachers in today's society.

The first dataset of secondary social studies teachers agreed that technology integration training is important; however, they also shared that they needed access to technical and human resource support to facilitate continued technology integration after training. In comparison to the teachers from the second dataset, social studies teachers in the first data set appeared to work in more technology rich school environment and had access to more computers per classroom, yet they did not demonstrate frequent technology integration after completing the training. Both sets of teachers desired mentoring opportunities as follow-up support to technology integrated training. All teachers in the second data set worked with a technology mentor and found the mentoring of the technology specialist “to be the most beneficial technology integration support received after training because it catered to their individual learning needs” (Zhao & Bryant, 2006, p. 58). According to these teachers, mentoring gave them the opportunity to expand their technology integration skills based on their current skill levels and provided ideas for technology integration coupled with specific state curriculum standards. Other benefits of mentoring included reduced preparation time as teachers had a mentor who was more familiar with technology and who provided integration ideas. Zhao and Bryant note that as mentoring continued, teachers in the second dataset became more and more willing and comfortable with integrating technology to enhance teaching and learning because they had guidance and support (2006), while teachers in the first data set still reflected hesitancy. With the support of a mentor, teachers revealed that they were better able to employ technologies available to them on a regular basis and toward a student-centered approach to teaching and learning. Technology integration training with continued mentor-support after training was more beneficial than technology integration training with no mentor support.

The technology driven nature of our global, information based society requires that technology integration is a part of teacher training. The lack of technology integration among teachers in American schools is a grave concern in education (Zhao & Bryant, 2006). It would be beneficial for teacher candidates and their cooperating teachers if they entered clinical internships and later first-year teaching jobs, with an understanding of the need for technology integration and how to successfully achieve effective technology practices in their instruction. In a 2012 study, Oigara and Wallace present findings which note the effectiveness of a mentoring program for preparing teacher candidates to integrate SMART board technology in their classroom instruction. SMART board technology systems consist of an interactive whiteboard, an LCD projector, and a computer equipped with applicable software. Computer images can be manipulated as they are displayed on the touch sensitive whiteboard. The user is able to access collaborative learning software which comes with this technology, SMART Notebook, or use other compatible software such as Microsoft Power Point. Additionally, the user can integrate Internet use and is able to manipulate the software from the computer or the interactive whiteboard. Participants in the study were enrolled in a methods course through which they were taught the practical and pedagogical use of instructional technology (Oigara & Wallace, 2012). The purpose of this study was to determine the appropriate support and training necessary for teacher candidates to become competent and effective interactive SMART board technology users and to pinpoint the challenges to the effective use of this particular technology in a school setting where access to technology, and the technology professional development of teachers has historically been limited (Oigara & Wallace, 2012). The instructor provided training on appropriate use of the technology, and provided continued guidance and instruction on implementation during the candidates' field placement for student teaching.

The study conducted by Oigara and Wallace (2012) had two phases. In phase one, 20 teacher candidates were introduced to SMART board integration in their methods course to help them become more familiar using the technology and to integrate its use in their clinical teaching experiences at their placement school. The instructor modeled the use of the SMART board during instruction and created opportunities for teacher candidates to use the technology in various ways. In phase two, a subset of seven teacher candidates who had participated in the SMART board training within the methods course were placed at a local school to complete preservice clinical teaching experience. Over a period of two semesters, teacher candidates were required to incorporate SMART board interactive activities in their instruction at least six times. The instructor remained available during this time and continued to mentor the teacher candidates regarding effective technology implementation.

The researchers conducted teacher candidate interviews to investigate the impact of technology training and mentoring on attitudes toward integrating SMART board technology in lessons and the challenges encountered while using the technology for instruction. Other data were gathered through pre and post teacher candidate surveys, teaching observations, reflective journals, field notes, informal feedback from cooperating teachers, and document analysis (SMART board technology based projects, unit plans, and lesson plans). Findings of this study highlight the importance of technology integration training and continued support for teacher candidates. The researchers found that developing the personal technology skills of the teacher candidates was an integral element of the methods course as it helped to facilitate them being able to use the interactive technology during the clinical experience (Zhao & Bryant, 2006). Survey data highlighted the importance of technology integration and support while learning to develop a teaching environment which encouraged rich technology integration. The researcher emphasized that technology training alone did not result in teacher candidates having high levels of technology use. On the other hand, access to instructional technology and ongoing support and mentoring regarding technology use was necessary in helping teacher candidates to implement what they had learned during their initial technology training in their methods course.

Graduate coursework. In addition to professional development and mentoring programs, schools have also promoted and/or facilitated teacher development by encouraging teachers to enroll in continuing education courses at the graduate level. Randle (2013) investigated the interactions and learning outcomes of teachers enrolled in an online graduate level course on evolutionary biology. The course was intended to improve the teachers' lesson planning in science and content knowledge. Spanning seven weeks, this science course was considered to be the equivalent of a semester-long graduate kevel course and was offered through the science teacher professional development program facilitated by the American Museum of Natural History. Twenty-four teachers participated in this study. Randle's (2013) mixed methods research analyzed data from various sources which included: a Nature of Science survey (Lederman et. al., 2001), a lesson plan analysis instrument (Jacobs, Martin, & Otieno, 2008), the Community of Inquiring coding instrument (Shea et al., 2010) used to analyze online discussion posts, and five teacher interviews. Data from each of these sources were used to assess participants' acquisition of scientific content knowledge regarding the Nature of Science and application of the material learned in the course to a classroom setting. Study findings assert that enrollment and participation in a graduate level course is a beneficial form of teacher development. In particular, the online learning environment was especially well-suited for nurturing critical thinking. In addition, online learning environments are useful and effective in facilitating the development of reflective learning communities for teachers. However, the researcher also highlighted that an analysis of the teachers who struggled during the course indicates that an online format for teacher development may not be suitable for all teachers. To be successful, teachers must exhibit consistent effort and possess effective written communication skills (Randle, 2013).

Proposed Solution

The proposed solution is an intervention designed to provide teachers at the study site with on-going collaborative technology professional development to improve their technology efficacy and enhance their instructional strategies through rigorous technology integration. The findings of the needs assessment which gathered survey data from 74% of teachers at the study site and the intervention literature reviewed in this chapter inform the choice of intervention. Sixty-five teachers at the study site will engage in ongoing and focused technology professional development from November to April of the 2017-2018 school year. Professional learning communities, referred to as Technology PLCs for the purpose of this study, will include all teachers at the study site who have a common planning block during the regular school day. Working in their PLCs, teachers will participate in fourteen technology development sessions focused on teachers enhancing their abilities to use the interactive smartboards provided in each classroom at the school and exploring methods by which to engage students in content specific activities requiring students to use their assigned laptop computers. As noted in the needs assessment findings, each of these technologies already exist at the study site and are familiar to most teachers but are not effectively used for daily technology-integrated instruction. Choosing to focus on improving the use of existing technologies is the most cost-effective and efficient method to improve teacher quality with respect to technology integration. As part of overall school improvement initiatives, the principal at the study site will require all participating teachers to attend each of the technology sessions. Teacher leaders within these groups will be identified to serve as mentors to teachers whose technology skills are not as advanced. These teacher leaders will include all department chairpersons who will form a focus group for this study and participate in technology training sessions prior to engaging in PLC sessions with the rest of the staff. Department chairpersons will be trained and given the knowledge and technology support they need in order to function as mentors to their colleagues in mixed PLC groups, and also to the members of their respective departments. The few teachers at the study site who have exhibited advanced technology integration knowledge and effectiveness in instruction will also be asked to serve as mentors to their colleagues. In addition, session facilitators (district personnel) will be available to mentor teachers after each technology PLC session and throughout the life of the study.

Chapter 4 Technology Professional Development

As previously mentioned in the needs assessment, the study site is a rural high school located in a southeastern state. The school struggles with a high rate of teacher turnover and a resultant teacher shortage in various subject areas. Often, the school's administration resorts to hiring teachers from alternative teacher certification programs, such as Teach For America (TFA), and international teacher programs, such as, Foreign Academic and Cultural Exchange Services (FACES) to fill vacant positions. The school's current faculty represents teachers who have taken various routes to achieving teaching certification. Different levels of teacher quality exist among the teachers. Specifically, the needs assessment indicated that the addition of various instructional technologies introduced in an effort to booster school improvement resulted in no significant increases in student achievement and overall school performance. Even though available, the technology resources are not being used effectively by teachers. The needs assessment indicated that teachers at the study site are in need of technology professional development in order to enhance their effective implementation of technology in instruction at the highest levels of the SAMR model (Hoilett-Frierson, 2016). To fulfil this need, an intervention presented via technology professional development was designed.

Data were collected and analyzed to determine whether focused technology professional development resulted in changes in the technology efficacy of participating teachers and the levels of technology integration they chose to employ. Research also sought to determine whether participation in technology PD would result in a change in teachers' perceived benefits of infusing technology in their classroom instruction. The professional development sessions were held during the spring semester of the 2017-2018 academic year and provided content focused on teaching teachers about various strategies which they could use to enhance their technology use for instructional purposes. Through these professional development sessions, teachers were equipped with knowledge and practical expertise regarding how best to make more effective use of the technology resources available. These resources include one-to-one laptop computers for students and an interactive smartboard in each classroom. The PLC design featured teachers working in collaborative groups to become familiar with specific content related to increasing student engagement through effective technology implementation for instructional purposes. This intervention approach was designed based on literature relating to teacher development (Bell & Gilbert, 1994; Ingvarson & Rowley, 2017), technology efficacy (Young, 1998; Paraskeva et al., 2008; Vannatta & Fordham, 2004), and technology integration (Graham et al., 2009; Keengwe et al., 2012; Maninger, 2006). In addition, literature relating to technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2009; Mishra & Koehler, 2006), and the SAMR model relating to levels of technology implementation (Puentedura, 2010) were referenced and used to structure the content of the professional development sessions. Professional development (Desimone et al., 2000; Garet et al., 2001; Guskey, 2002, 2009), professional learning communities (Chance & Segura, 2009; Graham, 2007; Levine & Marcus, 2010; Okojie, 2011), and mentor programs (May, 2000; Oigara & Wallace, 2012; Zhao & Bryant, 2009) were also the focus of literature referenced and informed the content of the intervention. Through the technology intervention, teachers engaged in focused technology professional development on a consistent basis. They were exposed to knowledge on technology use and introduced to various strategies of technology implementation to increase student engagement. Teachers were given time to collaborate with colleagues during and outside of the scheduled PD sessions and had access to technology mentors who provided additional feedback and support. Technology personnel from the school district, the school's digital resource coach (DRC), and the school's technology facilitator (the researcher) were the facilitators for the sessions. However, teachers were encouraged to participate and share their technology knowledge whenever such opportunities arose. Almost all teachers at the study site were involved in the study; this sample included teachers who were in their very first year of teaching as well as those who had been teachers for a number of years. The purpose of this chapter is to provide an overview of the intervention, state the purpose of the study, describe the research design, participation selection, data collection, and data analysis.

Intervention Framework

The intervention was designed to provide teachers with methods by which they could facilitate increased student engagement through the integration of technology. Teachers were introduced to the SAMR model (Puentedura, 2010) and given the opportunity to familiarize themselves with tasks and activities reflective of the four levels of technology integration: substitution, augmentation, modification, and redefinition. Teachers participated in technology professional development in three settings: selected faculty meetings, technology professional learning communities, and department meetings. These technology professional development sessions were held on Tuesdays and Thursdays during the regular school day. On one Tuesday each month, teachers met in their respective departments. On Thursdays, teachers met in their professional learning communities during their respective planning periods. Teachers were always asked to bring their laptop computers and the sessions were most often structured in such a way that had teachers engaged in the same technology integrated activities to which they were being introduced and asked to use in their classrooms.

Purpose of the Study

The purpose of this study was to provide teachers with needed technology professional development and to determine whether their participation in this training resulted in changes in their technology efficacy. The study also examined whether technology professional development led to changes in teachers' technology use for classroom instruction, according to the SAMR model (Puentedura, 2010). Lastly, teachers perceived benefits of using technology in the classroom were also investigated. The hypothesis was that teachers' participation in technology professional development would result in teachers' increased technology efficacy and their employment of higher levels of technology instruction. In addition, it was hypothesized that teachers' perceived benefits of using technology in the classroom, before and after participating in the study, may change. The research questions were:

RQ1: How does teachers' technology efficacy change after participation in technology professional development?

RQ2: To what extent did the technology intervention provide consistent and relevant technology professional development?

RQ3: What changes in technology integration align with higher levels of technology implementation?

RQ4: What are teachers' perceived benefits of infusing technology into their classroom instruction?

Method

Research Design

The technology intervention was designed to fulfill a critical need at the study site. Students attending this rural school should have access to similar educational opportunities related to technology as their peers in other geographical locations (Reimers, 2009). Ensuring that students receive effective technology integrated instruction, led by capable and knowledgeable teachers, will contribute to providing rural students with 21st century educational experiences required for success in school and into their professional pursuits. This intervention was implemented during the 2017-2018 school year and included 48 of 55 teachers currently employed at the study site.

The researcher chose a mixed methods approach in order to realize the benefits associated with both a qualitative and a quantitative approach to arrive at the most informed determinations regarding the effect of technology professional development on teachers' use of technology in their classrooms. Specifically, the researcher used the concurrent triangulation design (Creswell & Plano Clark, 2011). Qualitative and quantitative data were collected concurrently, analyzed separately, and then combined. This approach allowed the researcher to have a more in-depth understanding of the data being gathered and the opportunity to corroborate the findings from either research method. Quantitative statistics from the surveys administered before and after the intervention provided numerical indications, while qualitative data gave voice to the teachers participating in the study (Creswell & Plano Clark, 2011). These combined data were used to tell a complete story.

Process monitoring was conducted throughout the study because when a study is innovative, there is a possibility that unanticipated outcomes may result (Rossi, Lipsey, & Freeman, 2004). Furthermore, it is critical to demonstrate that resultant outcomes are functions of actual intervention activities as opposed to other unrelated factors affecting change. The proposed intervention was considered innovative in that it would result in extensive changes to how technology was being used at the study site. It was foreseen that in some instances, these changes would be considered far-reaching, because the intervention was intended to revamp the school's entire approach to technology implementation for instructional purposes. Teachers would be required to attend mandatory technology PD on a consistent basis and would be expected to immediately begin implementing technology changes in their instruction. It is not likely that all teachers, having so long done otherwise, (taught without technology or with only low levels of technology integration) would be comfortable, confident, or even willing to participate in such an endeavor, making what may be drastic changes to their instructional approaches. As such, there was the possibility that there would be unanticipated outcomes.

Study Site and Participant Selection

The study site was a rural high school situated in a south eastern state. In accordance with the principal's request (APPENDIX B), the researcher sought to include all 55 teachers; however, 48 participated. The school created and approved a new instructional technology improvement plan, and the procedures outlined in this chapter were included as part of the mandatory professional development activities for all teachers at the school. A pre-post design allowed the teachers to function as their own control group. Teachers completed two surveys and participated in classroom observations and interviews before the intervention was implemented. These initial data were compared to similar data collected during and after the period in which the technology intervention was implemented. Table 16 illustrates the research summary matrix used to facilitate data collection.

Table 15

Research Summary Matrix

Research Question	**Construct**	**Data Source**	**Item in Data Source**
Question 1: How does teachers' technology efficacy change after participation in technology professional development?	Efficacy	TPSA Focus group reflections Classroom Observations	TPSA, Items 1-6, 810, 12-14, and 16-34
Question 2: To what extent did the technology intervention provide consistent and relevant technology professional development?		Field notes/ Research Journal Focus group reflections	
Question 3: What changes in technology integration align with higher levels of technology implementation?	TPACK Facilitation of students' technology use at higher levels	TTIS Classroom Observations	All items - TIOI classroom observation instrument TTIS Survey Items 21-25, 30-61
Question 4: What are teachers' perceived benefits of infusing technology in their classroom instruction?	TK, TCK, TPK, TPACK	TTIS Focus group interviews	TTIS Survey, Items 10-14

Effect Size

The effect size used in this study was 0.50. Hill et al. (2008) used meta-analysis to determine that the average effect size of past educational interventions for quasi-experimental studies at the high school level was 0.24. In a 2011 study, Cifuentes et al. reflected a larger effect size of 1.31 over a three-year period in a study which specifically addressed a similar intervention as the study for which these procedural and outcome evaluation plans were designed. However, the multi-year study included all levels of schooling (elementary, middle, and high) which may have contributed to this result. According to Cohen's (1988) established conventions, these effect sizes represent extremes: very small (0.24) and very large (1.31). Considering this fact and other limitations, Cohen's established medium effect size of 0.50 (Cohen, 1988; Hill et al., 2008) was considered more reasonable and was employed. While the researcher examined prior studies, in an effort to arrive at a reliable effect size, it is important to note that in comparison to other regions, there is relatively little research on small, rural schools (Arnold et al., 2005; Gandara et al., 2001; Hardré, 2008; Sherwood, 2000). Approximately, 6% of existing research on K-12 schools features rural school settings (Hardré, 2008). Of the existing research, very few of the studies regarding educational interventions (in rural high schools) have published effect sizes.

A power analysis using G*Power software, where the statistical test of interest was a simple t-test of means: Difference from constant (one sample case), was conducted. This statistical test was chosen because study participants functioned as their own controls. Calculations determined that the total sample size for the suggested intervention was 27 for the 0.50 effect size. Research suggested that the median power to detect this effect size was between 0.37 and 0.46 (Cohen, 1962, 1992; Sedlmeier & Gigerenzer, 1989). Finding these values too low, I proposed that the value for desired power be set at 0.80, in accordance with Cohen's (1988, 1992) suggested power convention. Although the school's principal deemed the intervention as a mandatory school-wide initiative to include all teachers (anticipated *n* = 55), the final sample size was 48.

Measures or Instrumentation

Three instruments were used to collect data. These included one Likert-scale survey, the Teacher Technology Integration Survey (TTIS; Reinhart & Bannister, 2009; see Appendix C), the Technology Proficiency Self-Assessment (TPSA; Christensen & Knezek, 2017; see Appendix D), and the Technology Integration Observation Instrument (TIOI; Harris, Grandgenett, & Hofer, 2010; see Appendix E).

Teacher Technology Integration Survey (TTIS)

The Teacher Technology Integration Survey (TTIS) (Reinhart & Banister, 2009) (Appendix C) was administered to teachers through group administration as both a pre- and post-survey. The survey consisted of 61 questions and took approximately ten to fifteen minutes to complete on both occasions. This instrument measured six constructs of teacher technology integration:

1. Risk-taking behaviors and comfort with technology;
2. Perceived benefits of using technology in the classroom;
3. Beliefs and behaviors about classroom technology use;
4. Teacher technology use;
5. Facilitation of student technology use; and
6. Teacher support for technology use and access to technology (Reinhart & Banister, 2009).

Content validity of the TTIS was assessed by an expert panel which included five educators (two teacher education faculty with expertise in K-12 technology integration, two K-12 teachers with backgrounds in classroom technology integration, and one K-12 district technology coordinator (Reinhart and Banister, 2009). In addition, the researchers conducted a study involving 457 teachers to establish the reliability and validity of the TTIS. The researchers conducted factor analyses which confirmed that this survey was a reliable method by which to measure teachers' technology integration at the study site. During the reliability and validity study, after factor analyses were complete, internal reliability was assessed using Cronbach's alpha; results determined that the subscales included in the survey presented reliable means to measure teachers' technology implementation practices (Reinhart & Banister, 2009).

Items 1 through 9 and measured the emotional responses of anxiety or comfort when taking risks or addressing problems when using new technology. Items 10 through 14 on the TTIS addressed teachers' Perceived Benefits of Using Technology in the Classroom. These items measured how one discerns the academic and emotional benefits realized by both teachers and students as a result of using technology. Beliefs and Behaviors about Classroom Technology Use were addressed in items 15 through 20. These items gathered information regarding teachers' general beliefs and behaviors about technology use and considered the effect that these attitudes can have in a classroom setting. Items 21 through 25 on the TTIS focused on Technology Support and measured the degree to which technology integration is encouraged. Each of these constructs was presented on a 4-point Likert scale with the following choices: 1- strongly disagree, 2 - disagree, 3 - agree, and 4 - strongly agree.

Accessibility to technology support and curriculum support using technology were measured in items 26 through 29 on the TTIS and used a Likert scale with the following responses: 1 - Not available/present in my building, 2 - Available, but not accessible, 3 - Available but have limited access, and 4 - Available and have easy access.

The construct Teacher Technology Use (Teacher Administrative Use of technology, Teacher Communication Use, and Teacher Instructional Use) on the TTIS was measured on a five-point scale with the following choices: 1- never, 2 - once or twice a year, 3 - several times a year, 4 - several times a month, and 5 - several times a week. Items 30 through 35 addressed Teacher Administrative Use of Technology and asked how often teachers use technology to create instructional handouts or assessments for students, use the Internet to gather information for lesson planning, create electronic templates to guide student use of technology, prepare or maintain IEPs, use gradebook to maintain grades and/or attendance, and use a handheld device to organize information. Teacher Communication Use was addressed in items 36 through 38 where teachers were asked how often technology was used to post class information and use email to communicate with students, parents, colleagues, and other school district administrators. Teacher Instructional Use was measured in items 39 through 42. The items in this construct measured frequency of technology use in the classroom and also planning and integration methods employed by teachers using technology to facilitate teaching and learning, items asked how often technology was used to present information to students, demonstrate computer applications, provide/create electronic centers, and use technology to adapt activity to students' individual needs.

The construct, Facilitation of Student Technology Use was also important when it came to technology integration. The remaining items in the questionnaire, items 43 through 61, addressed this construct. Each item referred to a specific application and use, to indicate exactly how technology was being integrated. The 5-point frequency scale was applied here: 1 - never, 2 - once or twice a year, 3 - several times a year, 4 - several times a month, and 5 - several times a week. Items 43 through 45 addressed configuration of student use (not a subscale); teachers were required to indicate how often they employ a computer use configuration with students: work in pairs or small groups on the computer, work individually on a computer in a computer lab, and work individually on a computer in the classroom. Items 46 through 57 addressed the subscale Student General Use, various purposes including to produce paper-based products, to communicate or collaborate with peers, or to solve problems were listed, and teachers were asked to indicate how often they ask their students to carry out each activity. The final four items, 58 through 61, addressed a second subscale, Student Specific Use in relation to various technology devices such as content-specific software, handheld devices, and simulation/gaming software.

Technology Proficiency Self-Assessment (TPSA) Questionnaire

The Technology Proficiency Self-Assessment (TPSA) (Appendix D) was administered to teachers through group administration on two occasions, before and after their participation in the technology intervention. This instrument consisted of 34 items that measured teachers' technology self-efficacy as it related to effective technology integration in the classroom learning environment (Christensen & Knezek, 2017). The 34 items appeared in six subscales based on the International Society for Technology in Education (ISTE) standards. The scales included Email, the World Wide Web, Integrated Applications, Teaching with Technology, Teacher Professional Development and Instruction and Emerging Technologies for Student Learning, each represented on a scale where 1= strongly disagree to 5 = strongly agree. Originally, the TPSA was made up of only 20 items; however, Christensen and Knezek (2017) revised the initial questionnaire and added fourteen items which reflected technological advancements and their emerging uses in education. According to their research, the original 20 items continued to reflect reliabilities ranging from 0.81 to 0.93, while the 14 added items reflected internal consistency reliabilities greater than 0.90 (Christensen & Knezek, 2017). Data gathered from 195 pre-service and inservice teachers across four universities were used to determine the suitability and reliability of the revised TPSA. The new scales, which focus on emerging technologies, yielded Cronbach's Alpha internal consistency reliability estimates of 0.84 and 0.91 (Christensen et al. 2017).

For each of the scales, Christensen and Knezek (2017) inquire about teachers' selfassessed levels of confidence to carry out various technology related tasks. Those related to this study were used. World Wide Web asked about teachers' confidence in regards to using search engines, searching for and finding the Smithsonian Institute website, creating their own World Wide Web homepage, keeping track of websites visited using bookmarks, and finding primary sources on the Internet that can be used for teaching. Teaching with Technology asked about teachers' confidence in relation to creating a lesson or unit that incorporates subject matter software, writing an essay about technology use in their classes, using technology to collaborate with others including students, describing five software programs that they would use in their teaching, and writing a plan to buy technology for their classrooms. Emerging Technologies for Student Learning asked about teachers' confidence in terms of using social media for instruction, teaching in a one-to-one environment, integrating mobile technologies into their curriculum, finding a way to use smartphones for student responses, using mobile devices for students to access learning activities, and transferring photos or other data via smartphone. Teachers' Professional Development and Instruction items asked about teachers' confidence in terms of downloading and reading e-books, downloading and viewing streaming video clips, downloading and listening to podcasts, sending and receiving text messages, saving and retrieving files in a cloud-based environment, creating a wiki or blog for student collaboration, using online tools to teach students from a distance, and using mobile devices to connect with others for professional development.

Technology Integration Observation Instrument (TIOI)

The Technology Integration Observation Instrument (TIOI) is a TPACK-based technology integration evaluation instrument (Harris et al., 2010) and was used to document observation findings from two sets of classroom observations. Ten teachers were randomly chosen for observations before the intervention was implemented. The same ten teachers were observed for a second time at the end of the study. Findings for both sets of observations were compared and contrasted for an analysis of teachers' technology use before and after their participation in technology professional development.

The TIOI instrument began with a chart requiring the observer to document the teacher's curriculum topic, key instructional strategies or learning activities, and the digital and non-digital technologies being used for instruction. A second chart required the observer to document technology use according to six factors: Curriculum Goals & Technologies (matching technology to curriculum), Instructional Strategies & Technologies (matching technology to instructional strategies), Technology Selection(s) (matching technology to both curriculum and instructional strategies), Fit (considering curriculum, pedagogy, and technology together), Instructional Use (using technologies effectively for instruction), and Technology Logistics (operating technologies effectively). Each of these factors was measured on a four-point Likert scale with 1 being the lowest and 4 being the highest level of technology use. The score ranges for each factor were described to help the observer accurately document technology use. These descriptions are illustrated in Table 16.

Table 16

TIOI Likert Scale Description of Scores by Factor

Curriculum Goals & Technologies			
4	**3**	**2**	**1**
Technologies used in the lesson are strongly aligned with one or more curriculum goals.	Technologies used in the lesson are aligned with one or more curriculum goal.	Technologies used in the lesson are partially aligned with one or more curriculum goals.	Technologies used in the lesson are not aligned with one or more curriculum goals.
Instructional Strategies & Technologies			
4	**3**	**2**	**1**
Technology use optimally supports instructional strategies.	Technology use supports instructional strategies.	Technology use minimally supports instructional strategies.	Technology use does not support instructional strategies.
Technology Selections			
4	**3**	**2**	**1**
Technology Selection(s) are exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are appropriate, but not exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are marginally appropriate, given curriculum goals and instructional strategies.	Technology selection(s) are inappropriate, given curriculum goal(s) and instructional strategies.
Fit			
4	**3**	**2**	**1**
Curriculum, instructional strategies and technology fit together strongly within the lesson.	Curriculum, instructional strategies and technology fit together within the lesson.	Curriculum, instructional strategies and technology fit together somewhat within the lesson.	Curriculum, instructional strategies and technologies do not fit together within the lesson.
Instructional Use			
4	**3**	**2**	**1**
Instructional use of technologies is maximally effective in the observed lesson.	Instructional use of technologies is effective in the observed lesson.	Instructional use is minimally effective in the observed lesson.	Instructional use of technologies is ineffective in the observed lesson.
Technology Logistics			
4	**3**	**2**	**1**

Teachers and/or students operate technologies very well in the observed lesson.	Teachers and/or students operate technologies well in the observed lesson.	Teachers and/or students operate technologies adequately in the observed lesson.	Teachers and/or students operate technologies inadequately in the observed lesson.

According to Harris et al. (2010), this instrument reflects critical TPACK concepts and have proven to be both reliable and valid in two rounds of testing. The interrater reliability coefficient was 0.857 and was computed using Intraclass Correlation and a score agreement (84.1%) procedure. Using Cronbach's Alpha, internal consistency for the instrument was 0.911, and testretest reliability (score agreement) was recorded at 87%. In addition, the researchers assert that five TPACK experts confirmed the instrument's face and construct validities (Harris et al., 2010).

Procedure

Intervention Methodology

For the proposed program, teachers received the intervention by participating in extended technology professional development. Teachers had the opportunity to engage in 24 scheduled hours of meaningful professional training. As outlined in the previous chapter of this dissertation, research indicates that between 20 and 80 hours of instruction, practice, and coaching are necessary for professional development programs to be effective and facilitate teachers attaining mastery (Banilower, 2002; Dorn, 2005; Gulamhussein, 2013; Yoon et al., 2007). For the purpose of this intervention, teachers participated in three PD offerings. They engaged in technology professional development in their respective professional learning communities (PLCs) (10 hours), within their content-specific departments (8 hours), and in general faculty meetings (6 hours) from January 2018 to May 2018, spanning two quarters (9week grading periods) recognized by the study site, and which was equivalent to the time of one academic semester. Professional development took place in general faculty meetings after administrative business had been handled.

Professional Learning Communities (PLCs)

The intervention was scheduled according to the study site's existing master schedule. Teachers were grouped into technology learning communities (TLCs) according to previously established professional learning communities (PLCs), based on their planning periods during the regular school day. Content areas or same grade level teachers at the study site did not have the same planning period; as such, teachers reflecting various subject areas, grade levels, genders, and years of experience were grouped together for each PD session on Technology Thursdays. The school runs on a 4 × 4 block schedule; therefore, there were four groups with approximately 12 to 15 teachers in each group, and the same PD session was repeated during every block on Technology Thursday for the four planning periods. Working in their PLCs, teachers participated in seven professional development sessions (once per week). Six PLC meetings lasted one hour and thirty minutes, and the last session lasted one hour, for a total of ten of technology professional development sessions. PLC sessions were developed and facilitated by district personnel, the school's technology facilitator (the researcher), as well as the school's digital learning coach. These individuals worked with the principal at the study site to ensure that PD content directly related to improving the use of existing technology resources available at the school. Each PLC met on the same day (during teachers' respective planning periods) and covered the same technology integration training content across groups. Table 17 outlines a sample agenda for these meetings (See Appendices F-L), and Table 18 provides an outline of session content for each PD session which was held. Professional development sessions focused on teachers at the study site enhancing their instructional actions by learning how to effectively integrate technology into their lessons. Specifically, PD sessions covered levels of technology implementation according to Puentedura's (2010) SAMR Model (Figure 4), the use of SMART board technology, and various online platforms for engaging and effective laptop use. These online platforms included Quizlet, Padlet, Actively Learn, Mastery Connect, Mentimeter, Nearpod, Playposit, EdPuzzle, and Today's Meet (Table 17).

Figure 4

SAMR Model – Levels of Technology Implementation

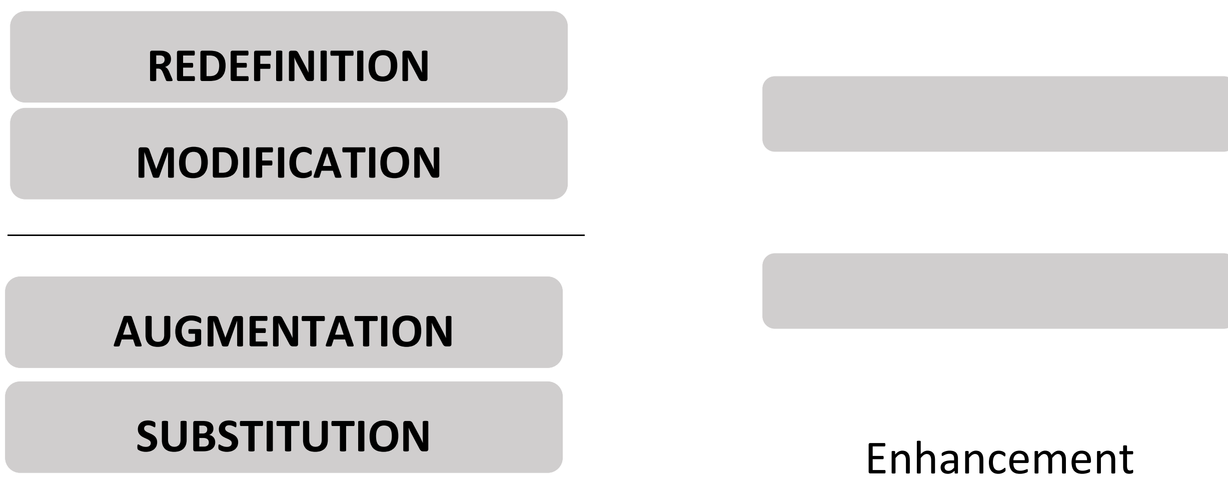

Figure 4 SAMR Model (Puentedura, 2010) showing delineation between too categories of technology implementation and each level within the two categories.

According to Puentedura's SAMR model (2010), there are two clear categories of technology integration: enhancement and transformation. This delineation is shown by a single line in figure 4. Within these categories, there are four ascending levels of technology implementation. For the lower category (enhancement) these levels include substitution and augmentation. For the higher category (transformation) these levels are modification and redefinition (Puentedura, 2010). At the lowest level of substitution, technology is used as a direct tool substitute and there is no functional change in how technology is to be used to complete the task assigned. In augmentation, technology is again a direct tool substitute but with functional improvement in how technology is to be used to complete the task assigned. In modification, technology allows for significant changes in lesson design involving innovative technology integration. The highest level of technology integration is redefinition, and technology facilitates the creation of new tasks which were previously inconceivable. Puentedura notes that instructional approaches which consistently integrate technology at the highest levels are most beneficial for student achievement (2010). Teachers at the study site were introduced to the SAMR model for effective technology integration, and each PD session facilitated the teachers engaging in activities to further enhance their application of the model in their instruction.

At the end of each session, teachers were encouraged to employ the technology integrated instructional strategies covered. Teachers' levels of technology implementation were categorized by low, medium, and high, and according to levels of technology use described by Puentedura's (2010) SAMR model. Low implementation was reflected through substitution and augmentation, medium implementation was reflected through modification, and high implementation was considered to be technology implementation requiring redefinition. Teachers were encouraged to integrate technology at the two highest levels of the SAMR model, modification and redefinition. However, it is important to note that before the intervention, it was established that several teachers did not integrate technology at all. As such, teachers were also encouraged to begin integrating technology at the two lower levels, with the intention of them gradually progressing to higher levels of effective technology integration. Teachers had the opportunity to report back to their PLCs to share their experiences as they incorporated the various technology integration ideas introduced to them during technology sessions. The researcher observed PLC sessions and recorded detailed notes in a research journal.

Table 17

Sample Technology PLC Meeting Agenda

• Meeting called to order
• Review of SAMR Model
• Interactive Technology Professional Development (PLC Session – Each session, teachers engaged in learning about different technology resources. See Appendices F-L)
• Technology Integrated Collaborative Lesson Planning (Working with mentors and same grade level teachers)

Each PLC session focused on the introduction of specific methods of technology integration to increase student engagement. Session facilitators first demonstrated the technology of focus through teacher engagement. That is, teachers used the technology resources and strategies being introduced in the same manner that they would have their students to use them. Facilitators then led an interactive period during which teachers themselves accessed the particular technology, created accounts when necessary, and navigated its offerings on their own laptops or other electronic devices. Following this period of teacher interactivity and familiarization, the teachers collaborated with mentors and same grade level teachers for lesson planning and regarding how best to use the introduced technology during instruction. Teachers from different subject areas worked together to help each other design technology integrated lessons. The school's digital resource coach, technology facilitator, and a lead teacher from each PLC group functioned as mentors providing additional feedback and one-to-one guidance for teachers. Table 18 outlines the specific content (and a description of its use) for each PLC session.

Each PLC session aimed to assist teachers in enhancing their instructional approach through introducing them to various resources and activities geared toward individual student interaction with technology. Sessions focused on different strategies that can be used through technology integration; they included using technologies such as Quizlet, Mastery Connect, Actively Learn, and Schoology and focused on student engagement by teachers providing specific student feedback to activities such as student blogs and self-paced assessments. The sessions exploring Quizlet and Nearpod focused on teachers using these strategies for lesson review after and during instruction to increase students' technology use and participation. Sessions covering content such as Today's Meet, AnswerGarden, and Mentimeter focused on teachers being able to increase student engagement by using these technologies to increase student participation by giving each student a voice in lessons. Nearpod, Actively Learn, and Playposit were strategies chosen to assist teachers in creating interactive lessons requiring students accessing presentations and answering questions to progress through lesson content. Teachers also engaged in sessions geared toward increasing student engagement and active participation through the use of the interactive smartboard and Schoology. These sessions helped teachers learn how to design lessons and lesson activities that use the interactive smartboard in ways that encourage student involvement as participants in lessons rather than spectators. The Padlet session helped teachers become familiar with technology integrated strategies to facilitate students' use of technology to create and submit various projects and presentations, as well as to facilitate technology integrated pair and group activities such as projects and peer review/editing. During weeks that the PLCs did not meet as a group, teachers were permitted time to meet with mentors and/or colleagues to revisit technology content from previous sessions to gain further clarification and increase their proficiency in using them during instruction.

Table 18

Technology PLC Session Content

PLC Session	Session Content
1	TTIS & TPSA Pre Survey Administration Using Mastery Connect to increase student engagement
2	Using Schoology - Teachers learned how to use Schoology to increase student engagement by creating assignments and providing specific student feedback through discussions and blogs.
3	SAMR model and using Nearpod for interactive lessons. Teachers explored the levels of the SAMR model and learned how to use Nearpod to facilitate greater student engagement through students' active participation in lessons using this medium.
	Making lessons interactive using the

4	Smartboard. Teachers learned how to use the smartboard to facilitate greater student engagement through students' active participation in lessons using this technology.
5	Teachers teaching teachers and Progress check: Collaborative review of SAMR and the learning platforms learned so far. Digital Resource Coach worked with individual teachers. Teachers also learned about Actively Learn and Quizlet and how to use these platforms for instructional purposes.
6	SAMR review. Using AnswerGarden for student feedback toward brainstorming and collaboration. Making lessons interactive using Today's Meet and Mentimeter. Teachers learned how to use AnswerGarden, Today's Meet, and Mentimeter to facilitate greater student engagement through students' active participation in lessons using these media.
7	TTIS & TPSA Post Survey Administration Teachers teaching teachers and Progress check. SAMR review. Revisited the learning platforms learned during technology PD. Teacher poll.

Content-Specific Department Meetings

To increase the likelihood of comfort with using technology for content specific integration, teachers also met with their departments once a month from January to April, to learn about various teaching strategies, collaborate, and plan. On these occasions, department meetings were originally designed as seven-hour professional developments sessions. However, due to scheduling conflicts and having to condense the semester's PD offerings due to inclement weather, department meetings were shortened to three and a half hour sessions. Two hours were dedicated to technology integration strategies and collaboration. The school's technology facilitator (the researcher) and the school's digital learning coach worked with the administrator responsible for curriculum to determine the technology focus of each content meeting. Teachers engaged in eight hours of content specific PD. Attendance logs and meeting minutes were maintained and used to track teacher attendance and participation in these meetings. Teacher leaders in the respective departments, the digital resource coordinator, session facilitators, including district technology personnel, and the school's technology facilitator served as mentors and provided additional support and feedback for teachers, during content-specific meetings, and between PLC sessions. As outlined in Chapter three, providing mentors is an ideal way to enhance teachers' technology efficacy and thereby increase their efforts and levels of effective technology implementation (May, 2000; Oigara & Wallace, 2012; Zhao & Bryant, 2006). The researcher met with each department chairperson to discuss the agenda and activities of the monthly content-specific meetings; these notes were added to the other qualitative data being collected for this study.

Faculty Meetings

During faculty meetings, teachers engaged in additional technology professional development by participating in short technology sessions where teachers had the chance to reflect on and evaluate their experiences with technology integration and ask questions. They were also exposed to technology integration strategies to teach their content. In addition, teachers who had success integrating the technology content covered in PLC sessions were asked to share their strategies and experiences with the entire group. These sessions were included in order to engage teachers in additional opportunities for meaningful reflection, evaluation, feedback, and support and provided an additional 6 hours of technology professional development throughout the duration of the intervention. As previously noted in Chapter 3, it is important for teachers to have opportunities to try out, evaluate, and practice new theoretical ideas and teaching suggestions over an extended period of time, in situations that promote collaboration, and in which teachers have access to support and feedback, and are able to reflect critically (Bell & Gilbert, 1994; Janssen & Lazonder, 2015; Kraft & Papay, 2014). The researcher observed faculty meeting technology sessions and recorded detailed notes in a research journal.

Data Collection

As previously mentioned, this research employed a mixed methods approach. Qualitative and quantitative strategies including semi-structured interviews, classroom observations, and pre and post surveys were used to determine the effect, if any, that technology professional development had on rural teachers' attitudes toward technology integration and the levels of technology implementation they choose to employ. Table 19 illustrates the mixed methods data collection and timeline for the study. Having multiple data points facilitated an opportunity for improvement to be seen over multiple time points. In other words, multiple data points gave the researcher the opportunity to analyze possible effects of the intervention throughout the process and not just at the end. Treatment effects were estimated based on a comparison.

Table 19

Mixed Methods Data Collection and Timeline

Measure	Quantitative	Qualitative	Data Collection Type	Timeline
Efficacy	x		Survey (Technology Proficiency Self-Assessment - TPSA)	January 2018 and May 2018
Change in technology use	x		Survey (Teacher Technology Integration Survey (TTIS)	January 2018 and May 2018

Participation (Including attendance and levels of use)	x	x	PLC Session notes, Classroom observations, Attendance logs for PS sessions	January 2018 to May 2018
Change in technology use, and perceived benefits of technology in the classroom		x	Semi-structured interviews	January 2018 and May 2018
		x	Classroom Observations	January 2018 and May 2018

A qualitative approach was used to help determine how teacher performance and instructional approaches changed over time. Semi-structured interviews were conducted with participating teachers. They lasted approximately 20 - 30 minutes. These interviews were conducted one respondent at a time; they were conversational and included the same closed- and opened-ended questions for all persons interviewed, frequently followed up by why or how questions (Torgerson, Torgerson, & Taylor, 2010). The researcher reviewed several similar studies including Adams (2015) and Keengwe et al. (2011) to determine appropriate interview questions. In the end, questions were formulated and finalized by the researcher and according to the research questions designed for this study. Table 20 illustrates these questions.

Table 20

Interview Questions for Teachers

Efficacy/ Change in Technology Use	How comfortable do you feel integrating technology in your lessons? Has your level of comfort changed since engaging in PD sessions? Describe how so.
Levels of Implementation	At which level of the SAMR model would you say that you are now implementing technology?

Topics	**Possible Questions for Teacher Interviews**
	Share a technology integrated instructional strategy that you have recently used in your class. Share a technology integrated instructional strategy that you have learned during PD and have used in your class.
Benefits of technology integration	What were your students' levels of participation and performance when you used this strategy? How useful have you found the PD sessions? How have your lessons changed in terms of technology integration? Has the learning environment in your class changed as a result of technology integration? Explain.

Survey. The researcher administered the Teacher Technology Integration Survey (TTIS; Reinhart & Banister, 2009) on two occasions. The first administration took place before teachers began technology professional development. The researcher administered these surveys a second time, at the end of the intervention. How teachers' efficacy towards technology integration changes over time was likely to affect levels of technology use over time. Possible changes include teachers' having increased technology efficacy and using higher levels of technology implementation to facilitate effective classroom instruction.

Comparison designs, such as the one chosen, are more conducive to shorter timeframes and resource constraints (Rossi et al., 2004). Given the suggested time frame of this study, having the teachers serve as their own comparison group proved valuable and insightful. Furthermore, designating a treatment group and a true control group was challenging as there was no sure way to guarantee that teachers in the control group had absolutely no technology integrated professional development during the period of the study, which was one semester.

Semi-Structured interviews and teacher reflections. Two sets of interviews were carried out during two phases of the study, at the beginning (before implementation) and end (after implementation). Midpoint data in the form of teacher reflections were also collected during the implementation of the intervention. Baseline data collected at the beginning of the study were compared to similar data at the midpoint and end of the study. Gathering interview data at multiple points helped the researcher to monitor fidelity of implementation as the study progressed and also to identify whether there seemed to be notable changes in teachers' use of technology earlier on in the intervention (by the midpoint) or later on in the intervention (after the midpoint) or both. The researcher interviewed six teachers at the beginning and end of the intervention. Teachers interviewed before implementation were chosen at random; however, teachers interviewed after implementation consisted of teachers identified as implementing technology at specific levels: low, medium, and high levels according to the SAMR model. At the midpoint of the study, teachers engaged in an online poll and discussion to determine their perceived levels of technology integration. Table 21 illustrates levels of implementation recognized for this study.

Table 21

Teachers' Levels of Technology Implementation

Level of Technology Implementation	Corresponding Level on SAMR Model	Description of Technology Use
High	Redefinition	Technology allows for the creation of new tasks, previously inconceivable
Medium	Modification	Technology allows for significant task redesign
Low	Augmentation	Technology acts as a direct tool substitute, with functional improvement
Low	Substitution	Technology acts as a direct tool substitute, with no functional change

During these interviews and through their reflections, teachers had the opportunity to share feedback detailing technology integrated strategies being employed at the study site. Teachers shared their personal experiences, noting whether they felt more confident or capable of effectively using technology for instructional purposes. They were asked to share how they believe teaching quality and performance were being affected. Conducting these interviews with teachers helped to highlight potential changes in teachers' technology efficacy and levels of technology implementation as a result of the treatment being implemented. Table 21 illustrate questions asked during teacher interviews.

Classroom Observations. A qualitative approach also guided classroom observations. The researcher used extensive notes gathered from multiple classroom observations to document and evaluate possible changes in teachers' technology integration. Ten participating teachers' classrooms were chosen at random and observed at two points of the study (beginning and end).

The TIOI proved effective in observing for active cognitive teacher engagement as opposed to compliance (Cifuentes et. al., 2011). Each observation lasted 25 to 30 minutes. The Technology Integration Observation Instrument was used to record data.

Focus Group Feedback (PLCs). The technology facilitator worked with the school's curriculum administer and digital learning coach to ensure that the agenda for each meeting included allotted time where teachers were given the opportunity to collaborate, design, and plan content-specific technology integrated lessons during PLC meetings. Time was also allotted for teachers to discuss program implementation. In these meetings, teachers shared with their colleagues the technology integrated instruction they had employed and analyzed the lessons they had completed. The teachers indicated and discussed their levels of technology implementation according to the SAMR model (Puentedura, 2010). Teachers also discussed their successes and failures and continued to collaborate with each other to design and/or enhance technology integration strategies. Teachers also had the opportunity to use this time to discuss any concerns that they had or aspects of technology integration with which they needed assistance.

Data Analysis. This section describes the data management plan, coding and statistical tests that the researcher used for qualitative and quantitative data analysis. Table 22 shows the research questions, data, timeline and method of analysis employed in this study.

Table 22

Research Questions, Data, Timeline, and Analysis

Research Question	**Data**	**Collection Timeline**	**Analysis**
Question 1: How does teachers' technology efficacy change after participation in technology professional development?	TPSA survey TTIS survey Interviews Classroom Observations	January 2018 through May 2018	Descriptive Analysis Thematic coding
Question 2: To what extent did the technology intervention provide consistent and relevant technology professional development?	Interviews	January 2018 through May 2018	Descriptive analysis Thematic coding
Question 3: What changes in technology integration align with higher levels of technology implementation?	Interviews TIOI Checklist Classroom Observations	January 2018 through May 2018	Paired t test
Question 4. What are teachers' perceived benefits of using technology in the classroom?	TTIS Survey	January 2018 through May 2018	Descriptive statistics

Data management plan

Data for this study was collected and filed in hardcopy form and electronically. Secured physical and electronic locations including a flash drive and safety box that locks were used to store data. Extensive notes were taken during teacher discussions and documented by the researcher following each meeting. Excel spreadsheets were created to document data gathered from classroom observations and interviews. The researcher also kept a research journal, documenting details of observed technology professional development sessions.

Qualitative Data Coding

Coding is the process of labeling ideas and grouping evidence "so that they reflect increasingly broader perspectives" (Creswell & Plano Clark, 2011, p. 208). The researcher gathered all qualitative data, including open-ended survey questions, classroom observation notes, PLC session notes, content-specific department meeting notes, faculty meeting technology session notes, and interview transcripts; these notes were reviewed and coded. The researcher reviewed the data for patterns and themes and created qualitative data codes. Initially, data were coded and labeled according to topics from the literature; however, based on the data, the researcher created new categories or groupings in addition to these a priori themes. The researcher developed and used a qualitative codebook to efficiently organize the data. In order to eliminate repeated groupings and refine emergent categories, the researcher continuously worked to organize and reorganize the information gathered from all qualitative data sources.

Statistical tests

The quantitative data gathered in this study were analyzed using a paired t test, where statistical significance was determined by a p value less than 0.05. Cronbach's alpha was found and documented for each survey, to ensure that there were good levels of internal reliability. Teachers' levels of technology implementation were categorized by low, medium, and high, and according to levels of technology use described by Puentedura's (2010) SAMR model and previously illustrated in Table 20. Low implementation was reflected through substitution and augmentation, medium implementation was reflected through modification, and high implementation was considered technology implementation requiring redefinition. Table 23 provides a detailed summary matrix highlighting the four research questions, applicable indicators and their roles, each data source, frequency of data collection, and the individual responsible for gathering the named data.

Summary Matrix

Table 23

Data Collection Matrix

Research Question	Indicators	Role of Indicator	Data Source	Frequency	Responsibility
Question 1: How does teachers' technology efficacy change after participation in technology professional development?	Technology professional development	Control Variable		PLC sessions – 9hrs Content-specific department meetings - 8hrs Faculty Meetings 6 hrs.	Researcher Digital Resource Coach, Study Site's Technology Facilitator
	Efficacy	Mediating Variable	TPSA Survey Teacher Interviews	Beginning and end (survey) Beginning, midpoint, end (interviews/reflections)	Researcher
Question 2: To what extent did the technology intervention provide consistent and relevant technology professional development?	Fidelity of implementation	Mediating Variable	Session notes Interviews	PLC sessions – 9hrs Content-specific department meetings - 8hrs Faculty Meetings 6 hrs.	Researcher

Question 3: What changes in technology integration align with higher levels of technology implementation?	Levels of technology implementation	Moderating/Mediating variable		Beginning, midpoint, end	Researcher
Question 4. What are teachers' perceived benefits of infusing technology in their classroom instruction?		Mediating Variable	TTIS Survey Interviews Focus group feedback	Beginning and end (survey) Beginning, and end (Interviews), Midpoint (Reflections) Focus group feedback	Researcher

Fidelity of Implementation

Fidelity of implementation can affect the outcomes of this study. In fact, poor implementation can result in the loss of program effectiveness (Dusenbury, Brannigan, Falco & Hansen, 2003). Measures of fidelity that the researcher assessed for this study focused on two aspects, the implementation of the intervention itself (dose, quality of program) and participant engagement (adherence, participant responsiveness). In terms of dose and quality of program, the intervention was administered with completeness as teachers engaged in between 20-80 hours of consistent professional development. In addition, program facilitators implemented the program knowledgeably and consistently, and in a manner that met the technology needs of the school.

Dusenbury et al. (2003) identifies several measures of fidelity. These include adherence, dose, quality of program delivery, participant responsiveness, and program differentiation. Following these guidelines, the proposed indicators of fidelity implementation for this study were participation logs, classroom observations, and focus group feedback. Each indicator directly related to the theory of treatment designed for this study. The suggested intervention was designed to manipulate inputs. Specifically, it addressed the instructional actions of teachers because improving teacher quality by enhancing their instructional actions was likely to result in beneficial outputs, namely enhanced technology integrated teaching and improved student learning. One limitation of fidelity for this intervention was that the researcher did not formally train the individuals who participated as mentors. Mentors included the study site's technology facilitator, digital resource coach, and teachers who were most comfortable and experienced using the technology resources introduced during professional development sessions.

Strengths and Limitations of Design

Both strengths and limitations existed within the chosen evaluation design. By definition, quasi-experiments lack random assignment; rather, there is assignment to condition. This lack of random assignment was considered a limitation because randomized experiments are often considered the standard when it comes to eliminating selection bias from impact studies (Henry, 2010; Shadish et al., 2002). Furthermore, when implemented correctly, random assignment creates two or more probabilistically similar groups where observed differences in outcomes are likely to be as a result of the treatment (Shadish et al., 2002), as opposed to any other variable or pre-existing condition. Failing to use randomization, quasi-experiments always raise concerns for bias and create less compelling support for causal inferences. For these reasons, using a randomized experiment for this study was considered.

However, a randomized experiment was not chosen. Despite being able to eliminate selection bias, this design was prone to other instances of bias. Individuals participating in this study were not given a choice. At the request of the school's principal, all teachers at the school were expected to engage in the mandatory technology professional development offered throughout the semester. While some teachers embraced the opportunity to learn more about technology integration and improve their craft by such means, others were not as interested. Some teachers attended the mandatory technology professional development sessions but failed to exercise fidelity in their implementation of technology integration strategies in their instruction. In addition, there were nine teachers who did not consistently attend Technology Thursday sessions. However, non-compliance is not tantamount to attrition; in fact, when noncompliant participants are retained in a study, attrition bias is avoided (Torgerson et. al., 2010).

Quasi-experimental designs run the risk of arriving at null effects because the signal is differenced out (Shadish et. al., 2002); the results reflect findings which are not significantly different from the expected result of a null hypothesis. In other words, a quasi-experimental design makes it more likely that the experimental outcomes fail to support or show expected effects. Similarly, loss of sample power and loss of generalizability are also possible (Shadish et. al., 2002). But using this evaluation design presented an advantage in that the researcher was forced to consider each of these possibilities, make threats explicit, and work directly to rule each one out. This evaluation design was also strengthened by the use of multiple data points and multiple class observations functioning as reflexive controls which helped to mitigate bias (Rossi et. al., 2004). Baseline data collected from the participating teachers before the intervention was compared to data collected from the participating teachers during and after the intervention. In other words, baseline data was collected before the intervention, allowing teachers to function as their own comparison group allowing the impact of the intervention to be measured by change in outcomes before the intervention, at the midpoint and at the end. More observations of the same teachers over time proved useful in answering the evaluation question by drawing attention to any changes in performance which occurred during or after exposure to the treatment.

An additional possible limitation to this study was foreseen as the researcher's status as an employee at the study site. The researcher has been employed as a teacher in that school for eleven years and currently serves as the school's technology facilitator and English department chairperson. It was anticipated that in some instances, individuals interviewed may not provide completely honest responses and instead share responses just as a favor to the researcher, instead of taking the interview questions seriously. However, the opposite appeared to have occurred. Participants' level of comfort with the researcher seemed to result in more candid responses and declarations, rather than participants seeking to appease the researcher by putting on a show during classroom observations and in interviews. Teachers did not shy away from questions detailing their technology integration practices and readily identified and shared their weaknesses with the researcher and with colleagues during Technology Thursday sessions.

The mentors used in this intervention did not engage in formal training. The digital resource coach, technology facilitator, and teachers who were more experienced and comfortable using technology resources functioned as mentors. This was also considered a limitation. Formal training and organization would strengthen this intervention by helping to ensure that all mentors are guiding and supporting teachers according to the same strategies and standards. This aspect was missing from this intervention. Providing formal training and deliberately tracking the amount of time mentors spend with teachers would also help to quantify the additional hours of PD beyond the counted 24 contact hours in which teachers engaged. The time that teachers spend collaborating with colleagues, exploring technology resources on their own, and actually working with mentors was not quantified for this intervention. However, these instances may prove to be very valuable in terms of teachers' technology development and changes in their technology efficacy.

Chapter 5 Results and Discussion

The purpose of this dissertation study was to examine whether there were changes in teachers' technology efficacy as a result of their participation in technology professional development. This dissertation also examined whether technology professional development led to changes in teachers' technology integration practices, according to the SAMR model (Puentedura, 2010). In addition, teachers' perceived benefits of using technology resources in the classroom were also explored. In Chapter 4, I shared the design of the research study; this chapter presents the findings for each of the four research questions posed. As previously mentioned, the focus of this study was guided by the following research questions.

RQ1: How does teachers' technology efficacy change after participation in technology professional development?

RQ2: What changes in technology integration align with higher levels of technology implementation?

RQ3: What are teachers' perceived benefits of infusing technology into their classroom instruction?

RQ4: To what extent did the technology intervention provide consistent and relevant technology professional development?

Teachers' Technology Self-efficacy (RQ1)

The first research question focused on teachers' beliefs regarding their abilities to effectively integrate technology for instructional purposes. Both quantitative and qualitative data were collected; selected items on the Technology Proficiency Self-Assessment (TPSA; Christensen & Knezek, 2017), a midpoint and final teacher self-assessment, teacher reflections, as well as, the researcher's notes from professional development sessions provided information for this analysis. The researcher perceived that teachers' technology efficacy would experience a positive change as a result of the teachers' participation in technology professional development. During the period of this research, the participating teachers all taught at the same rural south eastern high school, had access to similar technology resources (laptops, smartboard, school district licenses to Schoology and Mastery Connect) and took part in the same technology professional development sessions. They taught varying grade levels and subject areas. The teachers' previous experiences using technology for instructional purposes varied.

Various technology resources have been available to the teachers at the study site for several years. During the 2015-2016 school year, the school district purchased a laptop for each student enrolled at the school. The teachers were encouraged to use these devices, in addition to the interactive smartboards mounted in 90% of classrooms at the school (M. Morgan-Smalls, personal communication, April 27, 2017). However, as noted in Chapter 2, teachers shared that they were not provided with technology training or consistent professional development to support effective integration of technology in their lessons (Hoilett-Frierson, 2016). These results were evident in the classroom observations and interviews conducted prior to the implementation of the technology intervention at the school. Technology integration was not the norm. Teachers and students did not use the laptops, and teachers most often used the interactive smartboards to simply project PowerPoint presentations for students to copy notes. According to the levels denoted by Puentedura's SAMR model, technology integration at the study site, when it occurred, most often reflected the lowest levels of technology integration, substitution and augmentation. Prior to the intervention, teachers also revealed that they did not feel comfortable trying to integrate technology as they did not feel prepared or adequately knowledgeable (Hoilett-Frierson, 2016).

The Technology Proficiency Self-Assessment (TPSA; Christensen & Knezek, 2017) was first administered in January of the implementation semester. A sample of 44 teachers completed this survey during a general faculty meeting. After participating in the technology intervention, the same number of teachers completed the survey for a second time. This 34-item instrument measured teachers' technology efficacy in relation to effective technology integration in the classroom learning environment (Christensen & Knezek, 2017), of those items, 31 items provided data for this research question. Both administrations (pre and post) of the TPSA reflected internal consistency greater than 0.90 indicating good reliability. Cronbach's alpha was calculated as 0.96 and 0.94 on the pre- and post-survey, respectively.

Responses to TPSA items were measured on a Likert scale ranging from one to five, where one represented a response of strongly disagree and five a response of strongly agree. Before the intervention, the mean was 4.02, with a standard deviation of 0.744. These measures are in comparison to a post intervention mean of 4.33, with a standard deviation of 0.60, indicating that teachers' self-assessed technology proficiency increased after their participation in technology professional development. However, a paired t test was carried out to compare the difference between teachers' overall self-assessed technology efficacy before and after their participation in the technology professional development offered through this intervention. According to these data, there was a significant difference in teachers' levels of technology efficacy, indicated by a *p*-value of 0.018.

Midpoint teacher reflections and a one question teacher self-assessment survey were also used to gather data to address this research question. Teachers revealed that despite involvement in technology sessions in their departments and as a faculty during the first part of the intervention, they continued to express discomfort and low confidence using technology for instructional purposes. At the midpoint of the study, thirty-six teachers participated in the one question self-assessment that was embedded in one of the technology resources they were learning how to use, Nearpod. The poll required teachers to self-assess and identify their perceived levels of technology integration according to the SAMR model (to which they had been previously introduced). Table 24 illustrates that at the midpoint of the study, 69% of the teachers reported that they still continued to integrate technology at the two lowest levels of the SAMR model, substitution (47%) and augmentation (22%). As shown, most teachers integrated technology at the level of substitution. Only 28% of teachers thought that they integrated technology at the level of modification, and less than one percent of the teachers (0.03%) asserted that they integrated technology at the highest level: redefinition.

Table 24

Midpoint and Final Teacher Self-Reflection – Levels of Integration (SAMR Model)

	Midpoint Self-Assessment (n=36)	Final Self-Assessment (n=18)

SAMR Level of Technology Integration	# of Teachers	% of Teachers	# of Teachers	% of Teachers
Substitution	17	47	0	0
Augmentation	8	22	6	33
Modification	10	28	6	33
Redefinition	1	0.03	6	33

During a discussion of the midpoint results, teachers in each PLC session stated that they still felt unprepared and needed more time when it came to integrating technology efficiently. "I always need more time to play with these things (technology resource)" (Teacher R, May, 2018), "It takes time to get familiar with these sites" (Teacher M, May, 2018), and "I just need the time to get used to it (technology resource)" (Teacher K, May, 2018). Teachers also revealed that they were generally frustrated with technology resources that did not work well. Several teachers shared that they were still at the level of substitution because they simply needed more training while others expressed that the unreliability of the technology resources available, including poor internet connectivity, made technology integration more of "a hassle" or "disruption" rather than an innovative practice. Four teachers provided detailed insight regarding this matter. Teacher X, who has been teaching for twelve years noted:

> My technology integration has declined recently from modification to substitution because of the lack of stable working technology. It (this situation) requires double planning because the technology is really cheap and has operational problems as a result. I would rather use resources that are technology free. Even if they (the resources) lack technology, they won't fail me. (May, 2018)

Additionally, it is interesting to note that teachers also mentioned student resistance toward technology integration as a frustration they faced. Teacher W, a third-year teacher who was new to the school this year, shared:

> I find that students are not interested in using technology for educational purposes. Some students complain that they would rather write (pen and paper) or fuss that they do not know how to use the technology or would rather use a (traditional) textbook. (May, 2018)

These particular findings are interesting as they are indicative of Haberman's (2010) assertion that students so long exposed to the pedagogy of poverty (in this case stemming from a lack of technology infusion in their educational experiences) may very well demand that norm when teachers attempt to implement elements of good teaching (in this case technology integration at higher levels). Though students are not the focus of this study, acknowledging student resistance to technology integration is important as such could become a deterrent to teachers choosing to integrate technology. While some teachers may continue to try, others may resort to the comfort and acceptance of traditional methods of student engagement, whether or not they are effective.

During the final PD session, teachers were once again asked to self-assess and indicate at which level of the SAMR model they were integrating technology. Table 24 also illustrates these results. Teachers used Today's Meet, an online technology resource they had learned about in PD, to share their current levels of integration. Eighteen teachers participated in this final poll. The following question was posed, "Having participated in the technology PD sessions all semester, at which level of the SAMR model are you now integrating technology?"

Interestingly, no teachers considered themselves at the lowest level of integration, substitution. The 18 respondents were split evenly among the three highest levels of integration:

augmentation, modification, and redefinition. One teacher excitedly said, “I was on the second level when we started; I’m on the highest level now” (Teacher E, May, 2018). In discussing these results, teachers openly shared how they justified the levels that they indicated. Two teachers shared technology integrated lessons they had implemented in their classes. Teacher M, who had chosen her level of integration at augmentation on the midpoint poll excitedly noted that she had improved to the third level of modification.

> We were working on solving quadratic functions by square rooting [finding the square root and using it to solve the quadratic equation]. I used the smartboard during direct instruction, and the students were given the opportunity to come up and use the board’s interactive features. They had to teach the concepts to their peers. After direct instruction, I used Quizlet Live with a class of 29 students, and they loved it! They were very excited and engaged in this competitive review. The students did so well too! They were in teams and the students had to work together to submit the right answers using their cell phones or laptops to the questions posted on the smartboard. They had to collaborate in their groups and monitored their progress through Quizlet Live. (May, 2018)

Teacher N, who had chosen substitution on the midpoint poll shared her excitement after recently using one of the technology resources introduced during the PD; “Instead of having students to write discussion responses using pencil and paper or simply typing them, I created an online web blog where I post the question of the day” (May, 2018). Each student enrolled in her class had to sign up to the blog and participate in the online discussion. According to Teacher N, “Student participation increased” as most of her “students were involved in the discussion” (May, 2018). She also noted that student performance was higher as students more carefully edited their responses to ensure that their grammar was correct and they had directly answered the question asked; they knew that their classmates would be able to view their responses, and they did not want to perform poorly.

Findings asserted by these data were further corroborated by the researcher's field notes from professional development sessions. Similar to data findings from the TPSA survey and the teacher self-assessment, qualitative data, including teacher reflections, indicate that there was a noteworthy change in teachers' overall feelings toward technology integration. Over time, particularly after the midpoint of the study, more and more teachers became more willing to try and integrate technology and discuss their experiences during PLC sessions. Five teachers commented on how they felt about integrating technology as a result of participating in the training sessions. Teachers made such statements as: "I feel better about integrating technology now that I know more" (Teacher O, March, 2018), "This session was good; I feel better about using this (technology resource) in an actual lesson" (Teacher R, May, 2018), "I really like Actively Learn! I am going to use this!" (Teacher K, May, 2018), and "I am going to have the kids on here (Actively Learn) tomorrow! (Teacher C, May, 2018). Positive comments by teachers, their increased enthusiasm about using technology for instructional purposes, and their willingness to try to incorporate more and more of the technology resources introduced during PD sessions were significant actions which supported positive change as indicated by the quantitative data. The qualitative data supports a change in teachers' technology efficacy after their participation in the technology professional development provided.

Summary

According to the quantitative and qualitative data gathered for this research question, teachers' technology efficacy improved after their participation in 24 hours of technology professional development. Data collected from the TPSA survey, the teacher self-assessment, and other qualitative findings imply that technology professional development had a positive effect on teachers' technology efficacy. Even though various technology resources were previously available to teachers at the study site, teachers had not been provided with the adequate technology training or professional development teaching them how best to integrate technology and at higher levels of integration. Data gathered before the intervention indicated that technology integration was not the norm. Teachers at the school were not confident about how to successfully use technology for instructional purposes. When technology was employed, it was at the lowest levels of the SAMR model: substitution and augmentation. Prior to the intervention, teachers at the study site shared that they did not feel comfortable trying to integrate technology because they did not feel prepared or knowledgeable.

Teachers who participated in this intervention taught varying grade levels and content areas. Their previous experiences using technology for instructional purposes also varied. However, the teachers all taught at the study site, had access to the same technology resources and participated in the same technology professional development for the duration of the study. Quantitative data gathered from the TPSA survey support the researcher's hypothesis that teachers' technology efficacy would positively change as a result of their (teachers') participation in technology professional development. The Pre- and post-survey data as well as the qualitative data gathered indicate that teachers' technology efficacy experienced positive change after their participation in the intervention. Teachers were positively affected by their participation in the technology professional development provided. Over time, especially after the midpoint of the intervention, an increased number of teachers were more willingly to try and integrate technology and discuss their experiences.

Changes Aligned to Higher Levels of Technology Implementation (RQ2)

The second research question focused on what changes in technology implementation aligned to higher levels of technology integration, according to levels of the SAMR model (Puentedura, 2010). Qualitative and quantitative data were gathered using the Teacher Technology Integration Survey (TTIS; Reinhart & Bannister, 2009), the Technology Integration Observation Instrument (TIOI; Harris, Grandgenett, & Hofer, 2010), and the researcher's field notes each provided data for this analysis. At the beginning of the intervention and throughout its implementation, teachers often reviewed the four levels of the SAMR model (Puentedura, 2010). Teachers discussed content-specific examples reflective of each of the four stages, from lowest to highest levels of integration: substitution, augmentation, modification, and redefinition respectively. Teachers collaborated with their colleagues, including fellow teachers, session facilitators, the school's digital resource coach, and the school's technology facilitator to design instructional activities which required technology integration at each level of the SAMR model. The researcher noted that at the beginning of the intervention, the majority of teachers admitted to not integrating technology at all or only integrating technology at the lowest level, substitution. In teachers' pre-interviews and reflections, teachers indicated that they most often used the smartboard to show PowerPoint presentations from which students copied notes. Low levels of technology integration were also evident in the pre-intervention classroom observations. Before the intervention, classroom observations in ten core content area classes revealed four teachers (40%) integrating technology that required students to interact with the technology (laptop or interactive smartboard), while in the other six classes (60%), technology was only used to display information for students to read or to copy into their notebooks.

Quantitative data for this research questions included data gathered from items 21-25, 30 -

42, and 46-51 on the Teacher Technology Integration Survey (TTIS; Reinhart & Bannister, 2009). As mentioned in Chapter 4, content validity of the TTIS was assessed by an expert panel which included five educators (two teacher educator faculty with expertise in K-12 technology integration, two K-12 teachers with backgrounds in classroom technology integration, and one K-12 district technology coordinator (Reinhart and Banister, 2009). To further establish the reliability and validity of the TTIS in the context of this study, the researcher assessed Cronbach's alpha as 0.92 and 0.93 for the pre- and post-survey, respectively. These figures indicate high levels of internal consistency. A sample of 44 teachers completed the survey on both occasions providing data for a comparison of teachers' use of technology before the intervention and after the intervention. Teachers' responses on TTIS survey items helped to indicate whether there was a change in the level of technology integration. Participants recorded responses using a Likert scale ranging from one to five, where one represented a response of strongly disagree and five a response of strongly agree. For the subscales of technology support, teacher administrative and instructional use, teacher communication use, teacher instructional use, student general use, and student specific use, participants' mean score on the pre-survey was 3.16, with a standard deviation of 0.60. On the post-survey, the mean was higher, 3.81, with a standard deviation of 0.64. In addition, a paired t test of the pre- and post-survey mean scores indicated a significant difference between teachers' use of technology before and after their participation in the technology professional development sessions ($p=.0000$).

Table 25 below illustrates a comparison of pre- and post-survey means for each of the subscales represented by the survey items inquiring about a change in technology use.

Table 25

Pre- and Post-Survey Means for Selected Subscales (TTIS)

Subscale	Pre-Survey Mean	Post-Survey Mean
Technology Support	3.16	3.45
Teacher Administrative & Instructional Use	3.24	3.90
Teacher Communication Use	3.95	4.24
Teacher Instructional Use	3.35	4.03
Student General Use	2.81	3.88
Student Specific Use	2.24	3.36

According to these quantitative findings, teachers reported an increase in their accessibility to technology support and curriculum support. Teachers increased their use of technology to create instructional handouts or assessments for students, use the Internet to gather information for lesson planning, create electronic templates to guide student use of technology, prepare or maintain IEPs, use gradebook to maintain gradebook and/or attendance, and use a handheld device to organize information. In addition, there was an increase in how often teachers used technology to share class information and facilitate other communication. An increase in teachers' technology use and greater facilitation of student technology use was also indicated by the survey data. Findings indicated by the quantitative data are further supported by the qualitative data gathered by the researcher.

Teachers responded positively to the technology professional development. Thirty-eight teachers (84%) attended and participated in session activities regularly. As implemented, these sessions, along with teachers' access to mentors, increased teachers' accessibility to instructional technology resources and curriculum support. During content-specific department meetings and professional learning community (PLC) sessions, teachers had the opportunity to frequently collaborate. In sharing their lessons and detailing how introduced technology resources were used, teachers illustrated an increased use of technology and increased instances of them (teachers) facilitating student technology use. In one PLC session, teachers eagerly shared lessons that they had designed and taught in their efforts to integrate technology at higher levels and according to the levels of integration noted by the SAMR model (Puentedura, 2010).

Classroom observations before the implementation of the intervention revealed that teachers' use of technology mostly ranged from non-use to the second level of the SAMR model, augmentation. Teachers most often used the smartboards mounted in their classrooms to project PowerPoint presentations for students to copy notes. However, post intervention class observations indicated higher levels of integration as teachers were observed infusing the technology resources they were exposed to during the technology professional development sessions. Post observations found that technology integrated lessons were more interactive and student-centered. Guided by teachers, students manipulated various technology resources and were more active and engaged in the learning process.

A post observation done in Teacher T's class documented 30 students actively engaged and excited about a social studies lesson as they completed a web quest examining the distribution of services in urban areas. The students used individual laptop computers to access web links provided by the teacher. They read articles and answered questions, as well as, created an online urban map of a US state of their choice. The teacher used the LCD projector and smartboard to project examples and guide students through the process of accessing and creating interactive maps online. Teacher T commented, "As long as they (the students) are using technology and not writing, the kids are interested. We have to make activities creative!" (May, 2018).

Teachers became more confident in using technology for instructional purposes after learning more about technology resources during PD sessions. In an English class taught by a third year teacher who was in her first year at the study site, students worked in pairs and posted responses to discussion questions on an online blog. Student pairs worked on assigned laptops to collaborate, create responses, and submit their online posts. The teacher then projected each post on the smartboard and graded for all students to see. Teacher K explained that this approach allowed all students to benefit as each grading allowed them to peer review their classmates' work and learn from the mistakes they had made. All students were engaged in this task and appeared interested in the content and instructional strategy chosen by Teacher K. These instructional strategies were an improvement from those documented in Teacher K's preclassroom observation when technology was only used to project a PowerPoint from which students simply copied notes. When asked about her change in instructional strategies, Teacher K shared that participating in the technology sessions had proven to be very informative, and she was now more confident in her abilities to experience success with integrating technology (May, 2018). It is interesting to note that Teacher K was using Edublog, a technology resource that had not been introduced during a PLC session. The fact that Teacher K was using another technology resource was evidence that her interest and efforts to integrate technology at higher levels went beyond information provided to her during the mandatory PD; Teacher K had started to look for and use additional technology resources.

When asked to share whether the learning environment in their classes had changed as a result of technology integration, teachers most often identified significant changes such as "increased differentiation" and "more (student) engagement." Teacher C stated that using technology, students were able to go at their own pace, and that technology would definitely help her to differentiate instruction, especially for kids below grade level (May, 2018). Teacher H remarked that technology provided opportunity for more differentiation, was more interactive and engaging, and had already resulted in students performing better (May, 2018).

Summary

At the beginning of the intervention, teachers were introduced to the four levels of technology integration, according to the SAMR model (Puentedura, 2010). Teachers learned about various technology resources and collaborated with colleagues and mentors in their PLCs to design instructional activities requiring technology integration at each level of the SAMR model. Teachers were encouraged to integrate technology at higher levels.

Quantitative and qualitative findings indicate that after participating in the technology PD, teachers' technology integrated lessons were more innovative and interactive. Postobservations found that lessons were also more student-centered. With the guidance of their teachers, students were more actively engaged in the learning process. These changes came about as teachers increased their use of technology for instructional purposes and at higher levels of integration.

Teachers reported that the learning environments in their classes experienced positive change as a result of their integration of technology at SAMR levels of modification and redefinition, which are the two highest levels of integration. In addition, teachers, who prior to the intervention had not been using technology at all, also experienced positive changes in classroom environment as they began to integrate technology more and more, beginning with the lowest level of substitution and making the effort to gradually design and instruct lessons at higher levels of integration. According to the teachers, changes in classroom environment such as increased differentiation and more student engagement were valuable benefits directly associated with enhanced technology integration at higher levels.

Perceived Benefits of Infusing Technology (RQ3)

The third research question focused on teachers' perceived benefits of infusing technology into their classroom instruction. Both qualitative and quantitative data were collected; items 10-14 on the Teacher Technology Integration Survey (TTIS; Reinhart & Bannister, 2009) as well as data from focus group reflections provided information addressing this research question. As previously stated, the TTIS was implemented on two occasions, before and after teachers participated in the technology intervention. A total of 44 teachers completed the survey on both occasions. In terms of this research question, items on the TTIS survey measured how teachers discerned the academic and emotional benefits realized by both teachers and students as a result of using technology. Responses on the pre-survey resulted in a mean of 3.54, with a standard deviation of 0.42. This is in comparison to a post-survey mean of 3.61, with a standard deviation of 0.43. A paired t test was conducted to compare the difference between teachers' perceived benefits of technology integration before and after their participation in the technology intervention. According to the results, there was no significant change in teachers' perception; this is supported by a p value of 0.378. There was no significant difference in the scores on the pre-survey ($M=3.54$, $SD=0.42$) and post-survey ($M=3.61$, $SD=0.43$); $t(43) = -0.89$, $p = 0.378$. The quantitative data indicate that teachers at the study site, having participated in the technology intervention, realized no greater benefits of the use of technology for instructional purposes, while qualitative findings reveal that teachers' efforts to integrate technology are often hindered, leading to frustration, an unwillingness to use technology, and lost opportunities to realize the benefits of technology implementation. These findings are well supported by the qualitative data collected throughout the study.

During a faculty meeting technology PD session, teachers participated in an online blog prompting a discussion in response to the following question: *Describe the factors that contribute to the current digital learning environment in your classroom. What do you believe is needed to support your efforts to increase meaningful learning opportunities for your students?* Teachers participated in this online discussion during a mandatory faculty meeting while they were all seated at several tables in the same location. Thirty-six teachers and the session facilitator participated in this online discussion. Teachers' responses implied that they saw great benefits in using technology for instructional purposes and desired to do so. However, teachers discussed factors that posed a hindrance to their efforts. The most often mentioned factors were consistent with two major themes also revealed in teacher interviews and classroom observations: teacher discomfort due to a lack of technology training and the need for reliable technology resources. In terms of teacher discomfort, one teacher noted that she would, "Do more with digital learning opportunities if I had the time to actually learn the programs that are available" (Teacher A11, March 2018). Another teacher said, "I know that there are probably lots of resources out there, but it is a daunting task to sit down, figure out the applications and begin to think about how they can be applied in our courses" (Teacher A5, March, 2018). A third teacher stated that, "Currently the digital learning environment in my classroom is in need of improvement due to a lack of teacher comfort with a variety of digital learning technologies; training is needed in order to effectively incorporate these technologies into lesson planning and implementation" (Teacher A7, March, 2018). Another teacher shared, "I see the value of using technology in the classroom, but I need help in using it" (Teacher J, March, 2018). One teacher highlighted, "I believe that I personally need more training with Schoology and my smartboard. Schoology is a wonderful tool, and I would love to increase my knowledge" (Teacher S, March, 2018). Another teacher shared that she was most affected by her "lack of knowledge of how to go beyond the obvious" (Teacher G, March, 2018) in terms of technology integration. Another teacher stated that, "Better teacher instruction and learning opportunities pertaining to the available software would improve digital learning opportunities" (Teacher Q, March, 2018). "Not being able to fully understand how to use certain applications to guide and enhance students understanding is an issue…I need a professional development that will teach me how to effectively use educational applications to enhance learning" were the comments of another participant (Teacher R, March, 2018).

Several teachers expressed frustration in terms of the availability of good technology resources. Reliable internet access and working laptops were the resources most mentioned and most desired by teachers. One teacher noted that, "For a digital environment to be effective, there has to be reliable and effective technological resources, and we do not have that. Better access to speedy and reliable internet connection and updated computers would increase digital learning opportunities for the students" (Teacher Q, March, 2018). Another teacher noted that on the "few times" that she tried to use technology, "It was cumbersome to get devices to work" (Teacher A8, March, 2018). One teacher stated that, "Lack of continuous connection and reliability of the internet and devices contribute to the current (low) digital learning environment in my classroom" (Teacher G, March, 2018). Another teacher noted that while he saw the value of technology integration, his need was "better equipment" (Teacher J, March, 2018)." Another teacher noted that, "To increase the meaningful learning opportunities, our infrastructure needs upgrading along with better equipped devices to handle the advanced digital content available" (Teacher L, March, 2018). "Class laptops tend to act up most of the times, hence limiting my ability to have effective classroom engagement" (Teacher E, March, 2018). Another teacher shared that, "The main factor that contributes to the state of my classroom digital learning environment is the lack of technology" (Teacher I, March, 2018). Data reveal findings that indicate that teachers believe that there are various benefits to be gained from integrating technology, and they are interested in increasing their technology use in lessons. However, the primary issue teachers voiced was having little or no access to reliable technology resources.

Summary

A comparison of quantitative data collected before and after the technology intervention indicate no significant change in teachers' perception of the benefits of technology integration; teachers at the study site did not realize greater benefits of using technology for instructional purposes. However, the qualitative data gathered from teachers indicate that while they value technology integration and believe that there are benefits to such, they are often negatively overwhelmed by the lack of reliable technology resources available at the study site. Over the course of the intervention, teachers became more willing to incorporate the various technology resources introduced to them in their lessons. However, having enhanced their technology knowledge and expertise, teachers became frustrated with the inability to use or effectively implement everything they had learned. Throughout the study, teachers openly shared their opinions and frustrations regarding technology integration. The data indicate that while teachers at the study site find it important to integrate technology in their lessons, they are often discouraged by a lack of reliable technology resources at the school. Teachers frequently expressed frustration with setbacks, such as poor internet connectivity and laptops which do not work well.

Consistent and Relevant Technology Professional Development (RQ4) The fourth and final research question focused on the extent to which the technology intervention provided consistent and relevant technology professional development. Qualitative data gathered from the researcher's field notes and focus group reflections provided information for this analysis. The technology intervention was implemented during the second semester (January – May) of the 2017-2018 school year. Research on characteristics of effective professional development previously discussed in this dissertation mentioned that at least 20 hours of instruction, practice, and coaching are necessary for professional development programs to be effective and facilitate teachers attaining mastery (Banilower, 2002; Desimone & Garet, 2015; Dorn, 2005). The original proposal designated 50 hours of technology professional development for all participating teachers at the study site. Inclement weather at the beginning of the semester and the related school closures, resulted in conflicting schedules and the need to revisit the original program outline. However, teachers at the study site engaged in 24 hours of technology professional development and did so through three types of meetings: faculty and department meetings and professional learning communities (PLCs).

The needs assessment conducted for this study indicated that teachers lacked but desired professional development which would teach them how to better integrate technology in their instructional procedures. The implemented intervention consistently provided relevant technology training during the second semester of the 2017-2018 school year. Using the SAMR model (Puentedura, 2010) as a guide to higher levels of technology integration, teachers engaged in PD which introduced several technology resources and provided active learning opportunities for all participants. Active learning opportunities gave the teachers the chance to transform their teaching (Darling-Hammond et al., 2017) as opposed to simply layering new strategies on top of old ones. Characteristic of active learning, session facilitators afforded teachers multiple opportunities to participate in the same technology integrated learning activities they were designing for their students. Teachers were given time for collaboration during PLCs, and they also had the opportunity to receive feedback and guidance from mentors. Mentoring positively influences school climate, staff development effectiveness, teachers' technology confidence, and overall technology integration by the participants (May, 2000). The school's technology facilitator (the researcher), the digital resource coach, and a lead teacher in each PLC group provided this additional guidance for participating teachers.

The technology sessions were held consistently on the designated Tuesday and/or Thursday of each week. However, due to scheduling and rescheduling conflicts, most technology sessions during the first half of the intervention were facilitated on Tuesday afternoons after administrative business was handled in general faculty meetings. On the other hand, during the second half of the study, teachers mostly engaged in technology PD in their assigned PLC groups, which met on Thursdays during teachers' respective planning periods. Teachers also participated in technology training in their departments once a month from January to April.

The intervention sought to provide consistent technology training for teachers to improve their technology knowledge, skills, and overall technology efficacy. Seventy-five percent (n = 36) of study participants (n = 48) consistently participated in the implemented technology intervention. Technology resources explored included Mastery Connect, Nearpod, Quizlet, AnswerGarden, Schoology, Today's Meet, Mentimeter, Actively Learn, Padlet, and using the smartboard to make lessons more interactive. The researcher chose these resources because each one facilitated the teachers being able to use technology resources already available and in place at the school, including laptops, smartboards, and LCD projectors. Additional technology resources, such as Verso, were included in the original intervention proposal; however, due to time constraints and scheduling conflicts at the study site, less PD sessions were offered and only the technology resources listed above were introduced to participating teachers.

During technology PD, especially the PLC sessions, teachers openly discussed their feelings and interest regarding the mandatory technology sessions. They came to sessions prepared with lesson plans to use for technology collaboration and feedback, notepads to write down pertinent information, and laptops, tablets, or smartphones to access online resources introduced during the training. Though some teachers' initial responses to the PD opportunity were not positive, they ended being enthusiastic participants in the technology integration activities being explored for their use with students. The researcher observed teachers coming to meetings and documented some of their comments: "Why are we meeting today?" (Teacher A, March, 2018), “I have stuff to do” (Teacher E, April, 2018), “I have to use this time to plan,” (Teacher B, February, 2018), “This is too much” (Teacher T, March, 2018). However, at the end of technology sessions, the researcher also observed teachers leaving meetings and documented some of their comments: “It (the training) was worth my time.” (Teacher A, April, 2018), “This was a good session.” (Teacher P, March, 2018), “I liked this; I am using it tomorrow.” (Teacher C, March, 2018), “I am glad I came.” (Teacher A, April, 2018), “This is a great resource.” (Teacher T, April, 2018). Based on the differing responses from the beginning of sessions to the end of sessions, it is clear that these teachers were able to engage in and benefit from the technology training being offered. One teacher even remarked, “At first I was not pleased about coming today, but this (technology resource) made it worth it (Teacher K, May, 2018).

Throughout the intervention, teachers were often given time to collaborate while working in PLC sessions. They had the opportunity to work with colleagues in their content areas, as well as other who were not teaching the same content. The teachers often shared technology-related strategies and worked on technology embedded lesson plans together. During the PLC meetings, participants also had access to the school’s technology facilitator and the digital resource coach. These individuals, along with a lead technology teacher in the PLC sessions functioned as mentors throughout the study. The participants had access to mentors as that was an ideal way to enhance teachers’ technology efficacy and thereby increase their efforts and levels of effective technology implementation (May, 2000; Oigara & Wallace, 2012; Zhao & Bryant, 2006).

A key feature of the PLC sessions which differentiated them from the other two formats was the additional time for teacher collaboration and mentoring. As the technology intervention progressed, these characteristics appeared valuable to the teachers’ development. As previously noted, teachers commented on the significance of having more time with statements like, "I always need more time to play with these things (technology resource)" (Teacher R, May, 2018), "It takes time to get familiar with these sites" (Teacher M, May, 2018), and "I just need the time to get used to it (technology resource)" (Teacher K, May, 2018).

Participating teachers found the technology sessions beneficial to their practice. During post-interviews, three teachers openly shared their thoughts when asked, "How useful have you found the PD sessions?" Teacher K noted that she had found the sessions "very useful" as they made her aware of new resources and levels of (technology) integration (May, 2018). Teacher C also found the sessions to be very useful stating that she was now able to have access to websites she was previously unaware of. She was now able to move her lessons from being teacher focused to being student focused and more interactive (May, 2018). Teacher H noted that the sessions had been somewhat useful; when asked to explain, she shared that she knew a lot of strategies because she had recently taken courses to earn certification as an online teacher (May, 2018).

The data gathered and analyzed for this research question indicate that teachers were engaged in more than the minimum number (20) of hours of professional development required in order to affect change. Twenty-four hours of professional development were above the research recommended dose necessary for teacher improvement (Banilower, 2002; Desimone & Garet, 2015; Dorn, 2005). Teachers participated in on-going technology sessions throughout the period of the intervention and had access to mentors for additional feedback and guidance. Teachers also frequently collaborated with colleagues in and outside of their content areas to help enhance how technology was used for instructional purposes.

Based on the midpoint teacher poll data presented in the discussion of RQ1, teachers' perceived levels of integration showed no significant change from the intervention's beginning to the midpoint. At the midpoint, the majority of the participants (69%) shared that they integrated technology at the lowest levels of the SAMR model. However, the final poll reflected that teachers' own perceptions of their levels of integration changed drastically with only 33% of participants integrating technology at a lower level: augmentation. No teachers reported that they were integrating technology at the lowest level of substitution. These findings are supportive of the research asserting that involvement in longer periods of professional development is more likely to affect change (Banilower, 2002; Desimone & Garet, 2015; Dorn, 2005).

During PLC sessions, teachers openly discussed how their technology integrated lessons were going. A common concern shared by 100% of teachers participating in the PD was the lack of reliable technology resources at the study site. Comments such as, "cheap laptops" (Teacher A1, May, 2018), "No internet connection" (Teacher A2, May, 2018), "Unreliable" (Teacher N, March, 2018), and "The laptops don't work" (Teacher T, March, 2018) were often shared by frustrated teachers. One teacher remarked that, "All this technology knowledge would be good if we could actually use it, but there aren't enough working computers" (Teacher W, May, 2018). Another teacher noted that, "The internet connectivity is unreliable. All my kids (students) can't get on (online) at the same time" (Teacher S, March, 2018). Teacher Y shared:

> It doesn't make much sense having all this technology and technological know-how if the technology doesn't work well. We cannot really get innovative and creative if the technology keeps acting up or out rightly doesn't work. This causes frustration for both

> teachers and students. It is great and exciting to incorporate technology, but first we have to get the technology up and running smoothly, including both hardware and software. (May, 2018)

The needs assessment conducted for this study indicated that teachers lacked but desired technology training. However, now that the training has been provided, it appears that unreliable technology resources, including poor internet connectivity, is now a greater problem at the study site.

Summary

The technology intervention was implemented during the second semester (January to May) of the 2017-2018 school year. In keeping with research supported ideals, teachers engaged in more than 20 hours of instruction, practice, and coaching; they participated in 24 contact hours of consistent and on-going technology professional development. Originally, the intervention was designed to offer participating teachers at least 50 hours of technology training. However, due to time constraints and scheduling conflicts at the study site, this was not possible. Teachers were engaged in technology training in three formats: faculty meetings, department meetings, and professional learning communities (PLCs). However, additional hours of PD in terms of mentors working with teachers, teachers working with each other outside of PDs, and mentors guiding and supporting teachers were not quantified. The hours may also have proven influential to the intervention outcomes.

Throughout the period of the intervention, teachers were actively engaged and afforded many opportunities to participate in the same technology learning activities that they were designing for their students. They frequently collaborated with colleagues and worked with mentors. The school's technology facilitator, digital resource coach, and lead teachers in each PLC functioned as mentors and provided additional support for teachers during and between PD sessions.

Technology PD focused on teachers' use of technology for instructional purposes and at higher levels of integration, according to the levels of Puentedura's (2010) SAMR model. Tuesdays and Thursdays were noted as professional development days, and technology training was mandatory for all teachers employed at the school. Thirty-six teachers consistently participated in the technology training offered. This training explored teachers' use of technology resources already available at the school. These included one-to-one laptop computers and smartboards.

During the training, especially the smaller PLC meetings, teachers freely discussed their feelings and interests regarding the technology sessions. Both positive and negative opinions were shared as teachers made statements like, "Why are we meeting today?" (Teacher S, April, 2018), "What do you have for us today?" (Teacher J, April, 2018), "Will this take up all of my planning time?" (Teacher Q, May, 2018), and "I liked the last session." (Teacher C, April, 2018). Teachers often made negative comments but though they complained about having to attend the sessions, they always came prepared and participated. Teachers' negative demeanors before a session were often changed to positive ones by the end of the session. On several occasions, teachers willingly admitted that even though they did not want to attend a particular session, they were glad that they did because it provided much needed technology integration knowledge. The teachers made statements such as, "I found that last resource good" (Teacher A1, April, 2018), "I tried that resource you showed us with my students this week" (Teacher L, April, 2018), "I know a lot of technology resources, but you are introducing me to some new ones!" (Teacher H, May, 2018), and "I am going to have my students on this resources (Actively Learn) all the time (Teacher C, May, 2018).

Participating teachers found the technology sessions beneficial toward enhancing their instructional practices. The research data (midpoint poll) imply that, as research suggests, longer periods of involvement in focused professional development is more effective and productive for the participating teachers (Banilower, 2002; Desimone & Garet, 2015; Dorn, 2005). According to their own self-assessments shared through the midpoint poll, teachers' technology integration practices did not change much between the beginning and midpoint of the study, but experienced major change between the midpoint and the end of the study. Despite being involved in technology sessions in faculty and department meetings during the first half of the intervention, teachers were still uncomfortable and lacked confidence when it came to using technology for instructional purposes. However, from the midpoint to the end of the intervention, teachers were mostly engaged in technology PD in the PLC format, and their instructional use of technology increased drastically during this time.

Even though teachers' use of technology improved after their participation in technology PD, a significant number of teachers voiced concerns regarding the quality and reliability of the technology resources available to them. Many teachers noted that poor internet connections and laptops that did not work well were major hindrances to effective technology integration at higher levels. Teachers noted that the lack of reliable technology resources often discouraged them from wanting to integrate technology even though they have been empowered with the knowledge and skills of how to better do so.

Summary of Overall Data Results

The purpose of this research study was to examine whether participating in technology professional development would result in an increase in teachers' technology efficacy. This study also examined whether technology professional development resulted in changes in teachers' technology integration practices and/or their perceptions of the benefits of using technology resources for instructional purposes. A sample of 48 teachers participated in this study. Teachers taught different subject areas and varying grade levels in the high school.

Participants' previous experiences using technology to enhance their lessons also varied. However, all teachers taught at the same rural high school, had access to the same technology resources, and participated in the same technology professional development. Quantitative and qualitative data were gathered, analyzed and used to inform the findings of four research questions:

RQ1: How does teachers' technology efficacy change after participation in technology professional development?

RQ2: What changes in technology integration align with higher levels of technology implementation?

RQ3: What are teachers' perceived benefits of using technology in the classroom? RQ4: To what extent did the technology intervention provide consistent and relevant technology professional development?

Two surveys were administered and teacher interviews and classroom observations were conducted before and after the intervention was implemented. Pre- and post-survey data, teacher interviews, teacher reflections, a teacher poll, and pre- and post-observation data were useful in determining that teachers' technology efficacy experienced a positive change after teachers' participation in technology professional development. Over time, and particularly after the midpoint of the study, teachers became more willing and more enthusiastic to independently design and instruct lessons which required the use of the technology resources introduced during PD sessions. In addition, teachers integrated technology at higher levels of integration, as outlined by the SAMR model (Puentedura, 2010).

The principal at the study site was very supportive of the intervention and required all teachers to participate in the intervention. This helped to bolster teacher participation and the critical and full commitment to mandatory technology PD. For the duration of the study, teachers engaged in on-going and consistent technology professional development in three formats: faculty meetings, content specific department meetings, and professional learning communities. Tuesday and Thursday were designated PD days, and teachers were often provided with time for collaboration with fellow teachers and to work with mentors. The technology facilitator, the digital resource coach, and teachers who were comfortably using various technology resources functioned as mentors to other teachers who needed assistance. The mentors did not participate in formal training for this intervention. As designed, the technology intervention outlined 50 hours of technology professional development for teachers; however, due to time constraints and scheduling conflicts, teachers engaged in 24 hours of technology PD. However, despite failing to meet the outline 50 hours of PD participation, the data gathered for this research indicate that teachers participated in more than the minimum prescribed number (20) of hours of professional development to affect change.

Analysis of the quantitative data from the TPSA survey reveal that there was a significant difference in teachers' technology efficacy after their participation in the intervention.

Qualitative data from the teacher self-reflections, class observations, and PLC session notes also reveal that teachers were positively affected by their participation in the professional development. Data reveal that longer involvement in technology professional development proved to be more productive and effective for teachers. Teachers' self-assessed levels of instructional integration did not experience much change between the start and midpoint of the intervention even though teachers had been consistently engaged in technology PD as a faculty and in their departments. However, from the midpoint to the end of the intervention, teachers engaged in PD mostly in the PLC format and there was significant change in their feelings toward integrating technology and their willingness to do so. A feature of the PLC sessions which differentiated them from the other two formats in which PD was offered was increased time for teacher collaboration, and increased time for mentoring. As the intervention went on, this feature proved to be very valuable to the teachers.

It is interesting to note that at the end of the intervention, teachers' self-assessments determined that there were no teachers integrating technology at the lowest level of integration. Teacher interviews and classroom observations confirmed that teachers' changes in instructional practices aligned with higher levels of technology integration, according to the SAMR model (Puentedura, 2010). Classroom environments changed as technology integration at higher levels facilitated increased differentiation and increased student engagement. Lessons became more interactive and more student-centered.

Quantitative data collected from the TTIS survey indicate that there was no significant change in teachers' perception of the benefits of technology integration. However, an analysis of the qualitative data reveal that inadequate technology resources frequently hinder the teachers' efforts to integrate technology and most often results in them choosing not to do so. In reflections and teacher interviews, teachers at the study site shared their beliefs that there are various benefits to be realized from using technology for instructional purposes and are interested in using technology more in their teaching. However, several teachers voiced concerns about hindrances to effective technology integration. The most mentioned issues were poor internet connectivity and laptop computers that did not work. Teachers expressed delight in having knowledge of the various technology resources explored during the intervention, but they expressed frustration with the lack of dependable technology resources and a seemingly inadequate technology infrastructure. Teachers noted that these issues often affected how they taught their lessons and how much they attempted to incorporate technology at higher levels of integration.

Suggestions for Practice

Three suggestions for practice have been identified based on the findings of this study:

1. The classroom observations, teacher interviews, teacher reflections, and survey data gathered for this study indicate that consistent and ongoing professional development is indeed a critical factor which can have a positive influence on teacher quality, specifically in relation to teachers' technology efficacy and perceived benefits of technology integration. Teachers need opportunities to gain the technology knowledge necessary to effectively integrate technology in their instruction and at higher levels of integration. Significant changes were not seen in participants' instructional practices until after 14 – 20 hours of PD. Therefore, as aligned with previous research (Banilower, 2002; Desimone & Garet, 2015; Dorn, 2005) teachers should actively participate in collaborative and consistent technology professional development sessions for at least 24

contact hours each academic semester, amounting to approximately 48 hours throughout the school year.

2. This intervention referenced the SAMR model (Puentedura, 2010) to determine levels of technology integration for instructional purposes. Newer models of integration should be explored and the most appropriate model should be chosen for a particular school and teacher population. Relevant professional development should be designed to encourage and improve technology integration according to the model chosen.
3. All forms of qualitative data gathered for this study, including classroom observations, teacher reflections, and teacher interviews, produced data which indicated that unreliable technology resources were a great hindrance to teachers integrating technology at higher levels. As such, it is suggested that extensive research is conducted to determine whether the technology resources and infrastructure available at the school are best suited to the needs of the teachers, students, and school on a whole. Technology resources which are not useful will not contribute to teachers being able to effectively integrate technology at high levels.

Conclusion

Today's 21st century technologically-driven society demands schools which are capable of providing students with technology rich educational opportunities capable of preparing them for success in school and beyond school years. Some schools have readily adapted to these needs; however, there are others which are yet to really do so. Specifically, rural schools are among those which have integrated technology to a lesser degree, often as a result of a lack of technology infrastructure or resources (Bauch, 2001; Howley & Howley, 1995), hence creating a divide between the educational opportunities offered at rural and non-rural schools. This divide is unfortunate and unacceptable as a fourth of American children attends school in a rural setting (Ayers, 2011; Azano et al., 2014; Johnson & Strange, 2009; Johnson et al., 2012; Sundeen & Sundeen, 2013).

Students enrolled in rural schools have the right to a quality education. Undoubtedly, their educational experience should be up to par with that of their peers who attend schools in other geographic regions. However, students in a rural setting face various inequities and inequalities (Bauch, 2001; Brownell et al., 2005; Lowe, 2006; Roscigno et al., 2006; Sundeen & Sundeen, 2013). The inequalities include student diversity issues (Reed, 2010; Yeo, 1999), technology access (Sundeen & Sundeen, 2013), geographic location and socioeconomic struggles (Brownell et al., 2005), effective computer use in the classrooms (Beeson & Strange, 2003), as well as, the challenge of staffing rural schools with highly qualified teachers (Lowe, 2006; Rakes et al., 2006). Despite these challenges, rural schools can improve the education they offer through the use of innovative technology integration to enhance teaching and learning (Bauch, 2001). Rural schools can improve the quality of education that they offer by creating a school environment that fosters policies and practices focused on high levels of student performance (MacNeil et al., 2009). By creating such an environment, rural schools help to provide the educational experience fitting the demands of the 21st century society in which students exist and to which they are expected to contribute. To accomplish this task, a critical resource which rural schools must possess is a work force of highly qualified teachers who are knowledgeable, comfortable, and confident when it comes to using technology for instructional purposes.

Good teacher quality is a vital contributor to a positive rural school environment and high levels of student achievement. Indeed, student characteristics greatly impact and determine student outcomes (Coleman et al., 1966; Tuttle et al., 2010); however, research shows that teacher quality is the most significant school variable affecting student achievement (Coleman et al., 1966; Rivkin et al., Robinson, 2008). With this understanding, rural schools must endeavor to connect their rural teachers with the professional development and training needed to ensure that they carry out practices of good teaching (Haberman, 2010).

As noted by Haberman (2010), involving students in the technology access of information is a characteristic of good teaching. However, successfully involving rural students in the technology access of information also requires that rural teachers are familiar, confident, and comfortable when it comes to using technology for instructional purposes. The widespread use of computers results in the need for teacher training in the effective use of technology for instruction (Paraskeva et al., 2009). With an interest in enhancing the educational experience offered in a rural setting, this research explored how rural teacher quality could be enhanced by providing teachers with desired technology professional development.

Today's teachers must prepare students for a technology-driven future that is very different from the past and even what is being experienced in the present (Looi et al., 2008). Instruction that is enhanced with the integration of technology, at higher levels of integration, is an ideal way for rural teachers to meet this need. However, teachers who are not comfortable using technology or who think that they are unable to use technology effectively hinder this progress. Self-efficacy has an impact on teachers' use of technology (Paraskeva et al., 2006); according to this theory, teachers are likely to choose a level of innovation that they believe is manageable to them, whether or not it is the most effective or best technology option (Moersch, 1995) to enhance their instructional approach. In other words, what teachers believe that they can do plays an essential role in the instructional choices that they make, thereby contributing to the teaching and learning which takes place in their classrooms. As such, the standards and expectations observed by rural teachers, regarding technology integration, directly impact the overall school environment and student outcomes (Paraskeva et al., 2008; Young, 1998).

Teachers' technology efficacy helps to determine the instructional strategies they choose to employ (Moersch, 1995; Vannatta & Nancy, 2004); their knowledge and perceptions of their abilities to integrate technology for instructional purposes directly inform their actions (Moersch, 1995; Paraskeva et al., 2008). This research focused on the effectiveness of rural teachers' actions as affected by their knowledge pertaining to technology implementation.

This dissertation research study explored the experiences of forty-eight (48) high school teachers at a rural southeastern school. The needs assessment conducted for the purpose of this study indicated that teachers lacked but strongly desired technology professional development which would teach them how to more effectively integrate technology in their lessons and put to better use the technology resources already available to them. As such, the implemented technology intervention sought to provide teachers with much needed technology professional development in efforts to increase their technology efficacy and subsequent use of technology for instructional purposes. Research literature relating to teacher development (Bell & Gilbert, 1994; Ingvarson & Rowley, 2017), technology efficacy (Young, 1998; Paraskeva et al., 2008; Vannatta & Fordham, 2004), and technology integration (Graham et al., 2009; Keengwe et al., 2012; Maninger, 2006) informed the design of the implemented intervention. Literature relative to teachers' need to develop technological pedagogical content knowledge (TPACK) (Koehler & Mishra, 2009; Mishra & Koehler, 2006), and the SAMR model relating to levels of technology integration (Puentedura, 2010) were explored and used to inform the content of the professional development sessions. Additional literature focused on professional learning communities (Chance & Segura, 2009; Graham, 2007; Levine & Marcus, 2010; Okojie, 2011), mentor programs (May, 2002; Oigara & Wallace, 2012, Zhao & Bryant, 2009) and professional development on a whole (Desimone et al., 2000; Guskey, 2002, 2009) also influenced the content and design of the intervention.

According to the literature, at least 20 hours of professional development (instruction, practice, and coaching) are needed for professional development programs to be effective (Banilower, 2002; Desimone & Grant, 2015; Dorn, 2005). Teachers at the study site engaged in 24 contact hours of consistent technology professional development over the period of one semester, during the 2017-2018 academic year. On Tuesdays and/or Thursdays, teachers engaged in technology PD in one of three formats: faculty meetings, content-specific department meetings, or professional learning communities (PLCs). For the duration of the intervention, teachers were also given time during PLC sessions to collaborate with colleagues regarding technology integration for instructional purposes, at higher levels. The teachers also had access to session facilitators, the school's digital resource coach and technology facilitator, as well as other teachers who were comfortable using technology resources, who functioned as mentors between PD sessions. Longer involvement in professional development appeared most beneficial to teachers as participation in these sessions resulted in increased teacher enthusiasm and greater technology use after the midpoint of the study. The PLC format increased the amount of time teachers had to engage in collaboration with colleagues and had immediate access to mentors.

This mixed methods study sought to answer four research questions regarding teachers' technology efficacy, changes in technology implementation, the extent to which the implemented intervention provided consistent and relevant technology PD, and teachers' perceived benefits of technology integration. Pre- and post-surveys, classroom observations, teacher interviews, and teacher reflections each provided valuable data informing the findings of this research. Quantitative data collected from the TPSA survey indicate that there was a significant change in teachers' technology efficacy after their participation in the study. The qualitative data also supports the finding that teachers benefited from ongoing, consistent, relevant, and focused training in how best to use technology for instructional purposes. Evidence of higher levels of technology integration were evident in in the quantitative data gathered and was further corroborated by the qualitative data available. Teachers' efforts to integrate technology moved from the lowest levels of the SAMR model (Puentedura, 2010), substitution and augmentation, to the higher levels of modification and redefinition. In addition, teachers who admitted to not habitually using technology for instructional purposes began to do so. According to the study findings, after participating in technology professional development, teachers used technology resources less in terms of tool substitutes and more infused in lessons and activities which were previously inconceivable. Lastly, the quantitative data gathered revealed that there was no significant change in teachers' perceptions regarding the benefits of technology integration. Qualitative data showed that while teachers valued technology use for instructional purposes and thought that implementing technology could beneficial, unreliable technology resources often hindered their technology use and discouraged them from full integration.

Study findings support the assertions of various research upon which the conceptual basis of this intervention was designed. In addressing school environment, research suggested that through technology integration, rural schools are capable of enhancing the teaching and learning which occurs (Bauch, 2001). This suggestion was found to be accurate. In addition, the literature suggested that teachers' efficacy determined their instructional choices (Moersch, 1995; Vannatta & Nancy, 2004); specifically, teachers' technology efficacy directly contributed to their abilities to successfully integrate technology for instructional purposes (Paraskeva et al., 2008; Young, 1998). The more teachers participated in the intervention, the more enthusiastic and willing they became about using technology. As teachers' technology knowledge increased, so did the likelihood of them choosing to integrate technology in their lessons. Teachers also began to integrate technology at higher levels of integration. Teachers' participation in 24 hours of professional development which resulted in positive change, is also in line with the minimum number of PD hours suggested for professional development to prove meaningful and productive.

As previously mentioned, the implemented intervention focused on teacher development with the intention of improving teacher quality regarding technology integration for instructional purposes. The outcomes of this intervention support this study's conceptual framework which asserted that teachers' effective use of technology for instruction is influenced by their technology knowledge, skills, and efficacy. The technology development provided through this intervention gave teachers an opportunity to engage in meaningful, consistent, and collaborative activities geared toward increasing each of these characteristics, thereby improving the quality of the teachers who participated. The needs assessment indicated that teachers at the study site desired technology professional development. Study findings assert that they benefitted from their involvement in such activities. In light of this finding, the leadership at the study site should continue to engage all teachers in extensive, collaborative technology PLCs.

In addition to answering the research questions posed, study data also revealed that at the study site, reliable technology resources are lacking. Teachers are frustrated with the low quality laptops which they were given to help facilitate one-to-one student technology use because these computers do not work well. Investment in high quality devices is necessary and should be made a priority at the study site. Otherwise, it will continue to be difficult for teachers to make much progress in terms of effectively integrating technology for instructional purposes and at higher levels. Teachers also cite poor internet connectivity as a great hindrance to consistent technology integration. An investment in adequate infrastructure is also needed at the study site. The technology devices themselves and all other technology services, such as reliable internet access must be put in place and must be properly maintained.

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APPENDIX A

Needs Assessment - Teacher Interview Questions

7. How satisfied are you with the levels of interest in learning shown by your students?

   Very Satisfied Satisfied Somewhat Satisfied Not So Satisfied

   Not at All Satisfied/Dissatisfied.

8. How satisfied are you with the availability of technology resources at this school?

   Very Satisfied Satisfied Somewhat Satisfied Not So Satisfied

Not at All Satisfied/Dissatisfied.

9. How often do you use technology to enhance instruction?

   Daily Very Often Not so Often Not at ALL

10. In your experience, does student engagement increase during technology integrated instruction? Yes, definitely Sometimes No, not at all

11. In your experience, does technology integration lead to improved student performances?

    Yes, definitely Very Much So Somewhat Not so Much Not at All

    I do not use technology in lessons

12. When it comes to using technology to enhance instruction, how prepared and knowledgeable are the teachers at your school?

    Extremely prepared and knowledgeable

    Very prepared and knowledgeable

    Somewhat prepared and knowledgeable

    Not so prepared or knowledgeable

    Not at all prepared or knowledgeable

APPENDIX B

Principal's Request for All Teachers to be Included in Study

MEMO

RE: The Impact of Professional Development on Rural Teachers' Technology Self-Efficacy and Technology Use (Study)

Dear Ms. Hoilett-Frierson

It is my desire that all teachers at the school are included in the study named above. Technology professional development is a necessary for the development of 21st century educators. This study stands to benefit all involved, specifically, the teachers and the students at our rural high school.

Thank you,

Casandra Jenkins

Principal

APPENDIX C

Teacher Technology Integration Survey (TTIS)

Reinhart & Banister (2009)

Please select your level of agreement with each statement.

Risk Taking and Comfort with Technology		**SD**	**D**	**A**	**SA**
1	I feel comfortable about my ability to work with computer technologies.	1	2	3	4
2	Learning new technologies is confusing for me.	1	2	3	4
3	I get anxious when using new technologies because I don't know what to do if something goes wrong.	1	2	3	4
4	I am confident with my ability to troubleshoot when problems arise while using technology.	1	2	3	4

5	I get anxious when using technology with my students.	1	2	3	4
6	I get excited when I am able to show my students a new technology application or tool.	1	2	3	4
7	I am confident in trying to learn new technologies on my own.	1	2	3	4
8	I enjoy finding new ways that my students and I can use technology in the classroom.	1	2	3	4
9	Learning new technologies that I can use in the classroom is important to me.	1	2	3	4
Perceived Benefits of Technology Use		**SD**	**D**	**A**	**SA**
10	Using technology to communicate with others allows me to be more effective in my job.	1	2	3	4
11	Computer technology allows me to create materials that enhance my teaching.	1	2	3	4
12	Computer technologies help me be better organized in my classroom.	1	2	3	4
13	Technology can be an effective learning tool for students.	1	2	3	4
14	My students get excited when they use technology in the learning process.	1	2	3	4
Beliefs and Behaviors about Classroom Technology Use		**SD**	**D**	**A**	**SA**
15	Teaching students how to use technology is a part of my job.	1	2	3	4
16	Using technology in the classroom is a priority for me.	1	2	3	4
17	When planning instruction, I think about how technology could be used to enhance student learning.	1	2	3	4
18	When planning instruction, I consider state and national technology standards.	1	2	3	4
19	I regularly plan learning activities/lessons in which students use technology.	1	2	3	4
20	I try to model effective technology use for my students.	1	2	3	4
Technology Support		**SD**	**D**	**A**	**SA**
21	My building principal encourages faculty to integrate technology in the classroom.	1	2	3	4
22	Technology support is available in my building to assist with troubleshooting.	1	2	3	4

23	A vision for technology use in our school is clearly communicated to faculty.	1	2	3	4
24	My colleagues are committed to integrating technology in the classroom.	1	2	3	4
25	Curriculum support is available in my building to assist with technology integration ideas.	1	2	3	4

Please select the response that best reflects your level of access to the following types of technology:

1=Not available/present in my building

2=Available, but not accessible (can't use or sign up for)

3=Available but have limited access

4=Available and have easy access

Technology Access		1	2	3	4
26	Instructor computer	1	2	3	4
27	Set of computers (2-5) in classroom	1	2	3	4
28	Mobile computer lab (cart of computers)	1	2	3	4
29	Computer lab (10-30 computers)	1	2	3	4

For the items 30-42, please select YOUR level of frequency for completing the following tasks:

1=Never

2=1-2 times a semester

3= Several times a semester

4=Several times a month

5=Several times a week

Teacher Administrative and Instructional Use		1	2	3	4	5
30	Use the computer to create instructional handouts or assessments for students	1	2	3	4	5
31	Use the Internet to gather information for lesson planning	1	2	3	4	5
32	Create electronic templates to guide student computer use	1	2	3	4	5

33	Prepare or maintain IEPs on the computer	1	2	3	4	5
34	Use a handheld device (Palm Pilot) to organize information	1	2	3	4	5
35	Use spreadsheet (or grading program) to maintain grade book and/or attendance	1	2	3	4	5
Teacher Communication Use		**1**	**2**	**3**	**4**	**5**
36	Use Email to communicate with colleagues and administrators in your school/district	1	2	3	4	5
37	Use Email to communicate with students or parents	1	2	3	4	5
38	Post class information (homework, products) on an electronic bulletin board, website, or blog	1	2	3	4	5
Teacher Instructional Use		**1**	**2**	**3**	**4**	**5**
39	Use technology to present information to students	1	2	3	4	5
40	Demonstrate computer applications	1	2	3	4	5
41	Provide/create electronic learning centers	1	2	3	4	5
42	Use technology to adapt an activity to students' individual needs	1	2	3	4	5

For the remaining items, please select the level of frequency in which YOU ASK YOUR STUDENTS to complete the following activities:

1=Never

2=1-2 times a semester

3= Several times a semester

4=Several times a month

5=Several times a week

Configuration of Student Use (not a subscale)		**1**	**2**	**3**	**4**	**5**
43	Work individually on the computer in the classroom	1	2	3	4	5
44	Work individually on the computer in a computer lab	1	2	3	4	5
45	Work in pairs or small groups on the computer	1	2	3	4	5
Student General Use		**1**	**2**	**3**	**4**	**5**
46	Use Internet to research topics and gather information	1	2	3	4	5

47	Use spreadsheets or tables to organize and analyze data	1	2	3	4	5
48	Use spreadsheets to create graphs or charts	1	2	3	4	5
49	Use email to communicate and collaborate with peers	1	2	3	4	5
50	Use word processor for writing assignments	1	2	3	4	5
51	Use writing tools in word processor (such thesaurus, spell-check) to improve writing quality	1	2	3	4	5
52	Use presentation software to present information	1	2	3	4	5
53	Use technology to produce pictures/artwork	1	2	3	4	5
54	Use technology to produce paper-based products (newsletters, brochures)	1	2	3	4	5
55	Use technology to produce multimedia projects that use digital images, video, audio	1	2	3	4	5
56	Use technology to produce web pages or websites	1	2	3	4	5
57	Use technology to solve problems	1	2	3	4	5
Student Specific Use		**1**	**2**	**3**	**4**	**5**
58	Use a handheld device to gather and/or organize data, create concepts maps, write	1	2	3	4	5
59	Use content-specific software for concept reinforcement	1	2	3	4	5
60	Use Inspiration (or other) to create concept maps or graphic organizer	1	2	3	4	5
61	Use simulation/gaming software (Timeliner, Hollywood High) to learn and apply information	1	2	3	4	5
Overall Teacher Technology Use (items 30-42)						
Overall Student Use (items 46-61)						

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APPENDIX D

Technology Proficiency Self-Assessment for 21st Century Learning (TPSA C21)

I feel confident that I could...

	SD	D	U	A	SA
1. ...send e-mail to a friend.	1	2	3	4	5
2....subscribe to a discussion list.	1	2	3	4	5
3. ...create a distribution list" to send e-mail to several people at once.	1	2	3	4	5
4....send a document as an attachment to an e-mail message.	1	2	3	4	5
5....keep copies of outgoing messages that I send to others.	1	2	3	4	5
6. ...use an Internet search engine (e.g., Google) to find Web pages related to my subject matter interests.	1	2	3	4	5
7. ...search for and find the Smithsonian Institution Web site.	1	2	3	4	5
8. ...create my own web page.	1	2	3	4	5
9. ...keep track of Web sites I have visited so that I can return to them later. (An example is using bookmarks.)	1	2	3	4	5
10. ...find primary sources of information on the Internet that I can use in my teaching.	1	2	3	4	5
11. ...use a spreadsheet to create a bar graph of the proportions of the different colors of M&Ms in a bag.	1	2	3	4	5
12. ...create a newsletter with graphics.	1	2	3	4	5
13. ...save documents in formats so that others can read them if they have different word processing programs (e.g., saving Word, pdf, RTF, or text).	1	2	3	4	5
14. …use the computer to create a slideshow presentation.	1	2	3	4	5

15. ...create a database of information about important authors in subject matter field.	1 a	2	3	4	5
16. …write an essay describing how I would use technology in classroom.	1 my	2	3	4	5
17. ...create a lesson or unit that incorporates subject matter software as an integral part.	1	2	3	4	5
18. ...use technology to collaborate with teachers or students, who are distant from my classroom.	1	2	3	4	5
19. … describe 5 software programs or apps that I would use in my teaching.	1	2	3	4	5
20. ...write a plan with a budget to buy technology for my classroom.	1	2	3	4	5
21. …integrate mobile technologies into my curriculum.	1	2	3	4	5
22. …use social media tools for instruction in the classroom. (ex. Facebook, Twitter, etc.)	1	2	3	4	5
23. …create a wiki or blog to have my students collaborate.	1	2	3	4	5
24. …use online tools to teach my students from a distance.	1	2	3	4	5
25. …teach in a one-to-one environment in which the students have their own device.	1	2	3	4	5
26. …find a way to use a smartphone in my classroom for student responses.	1	2	3	4	5
27. … use mobile devices to connect to others for my professional development.	1	2	3	4	5
28. … use mobile devices to have my students access learning activities.	1	2	3	4	5
29. … download and listen to podcasts/audio books.	1	2	3	4	5
30. … download and read e-books.	1	2	3	4	5

31. … download and view streaming movies/video clips.	1	2	3	4	5
32. … send and receive text messages.	1	2	3	4	5
33. … transfer photos or other data via a smartphone.	1	2	3	4	5
34. … save and retrieve files in a cloud-based environment.	1	2	3	4	5

Adapted by R. Christensen & G. Knezek based on the TPSA created by and used with permission of Dr. Margaret Merlyn Ropp.

TPSAC21 v 2.0

APPENDIX E

Technology Integration Observation Instrument (TIOI)

Technology Integration Observation Instrument

Observer Teacher Date

Grade Level(s) ________

Subject Area(s)

Primary Learning Goals

Directions:
We have tried to key the components of this instrument to different aspects of teachers' knowledge for technology integration. Please note, however, that the instrument is *not designed to assess this knowledge directly.* It is designed to focus upon the use of technology integration knowledge in observable teaching. Please record the *key curriculum topics addressed*, *instructional strategies/learning activities observed*, and *digital and non-digital technologies used* by the teacher and/or students in the lesson.

Curriculum Topic	Key Instructional Strategies/Learning Activities	Digital[1] & Non-Digital[2] Technologies

What, if anything, do you know about influences upon what you have observed in this lesson? Examples might include students' learning needs, preferences, and challenges; access to technologies; cultural, language and/or socioeconomic factors.

Technology Integration Observation Instrument

Directions: Referring to the notes you made on the previous page, including your responses to the question about influences, please complete the following rubric, considering the lesson as a whole.

[1] Computer-based (e.g., software, Web-based resources, video or audio recorder, document camera, calculator)

[2] Not computer-based (e.g., overhead projector, textbook, whiteboard, pen/pencil/marker)

	4	3	2	1
Curriculum Goals & Technologies (Matching technology to curriculum)	Technologies used in the lesson are strongly aligned with one or more curriculum goals.	Technologies used in the lesson are aligned with one or more curriculum goals.	Technologies used in the lesson are partially aligned with one or more curriculum goals.	Technologies used in the lesson are not aligned with one or more curriculum goals.
Instructional Strategies & Technologies (Matching technology to instructional strategies)	Technology use optimally supports instructional strategies.	Technology use supports instructional strategies.	Technology use minimally supports instructional strategies.	Technology use does not support instructional strategies.
Technology Selection(s) (Matching technology to both curriculum and instructional strategies)	Technology selection(s) are exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are appropriate, but not exemplary, given curriculum goal(s) and instructional strategies.	Technology selection(s) are marginally appropriate, given curriculum goal(s) and instructional strategies.	Technology selection(s) are inappropriate, given curriculum goal(s) and instructional strategies.
"Fit" (Considering curriculum, pedagogy and technology all together)	Curriculum, instructional strategies and technology fit together strongly within the lesson.	Curriculum, instructional strategies and technology fit together within the lesson.	Curriculum, instructional strategies and technology fit together somewhat	Curriculum, instructional strategies and technology do not fit together within the lesson.

			within the lesson.	

	4	3	2	1
Instructional Use (Using technologies effectively for instruction)	Instructional use of technologies is <u>maximally effective</u> in the observed lesson.	Instructional use of technologies is <u>effective</u> in the observed lesson.	Instructional use of technologies is <u>minimally effective</u> in the observed lesson.	Instructional use of technologies is <u>ineffective</u> in the observed lesson.
Technology Logistics (Operating technologies effectively)	Teachers and/or students operate technologies <u>very well</u> in the observed lesson.	Teachers and/or students operate technologies <u>well</u> in the observed lesson.	Teachers and/or students operate technologies <u>adequately</u> in the observed lesson.	Teachers and/or students operate technologies <u>inadequately</u> in the observed lesson.

Comments:

Technology –

APPENDIX F

PLC Meeting Agenda Session 1

Meeting called to order

- Review SAMR Model
- Interactive Technology Professional Development

TTIS & TPSA Pre Survey Administration

Using Mastery Connect to increase student engagement

Teacher one-question self-assessment survey

- Technology Integrated Collaborative Lesson Planning

Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

APPENDIX G

PLC Meeting Agenda Session 2

Meeting called to order

- Review SAMR Model

Technology –

- Interactive Technology Professional Development
  Using Schoology - Teachers will learn how to use Schoology to increase student engagement by creating assignments and providing specific student feedback through discussions and blogs
- Technology Integrated Collaborative Lesson Planning
  Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

APPENDIX H

PLC Meeting Agenda Session 3

Meeting called to order

- Review SAMR Model
- Interactive Technology Professional Development
  SAMR model and using Nearpod for interactive lessons. Teachers will explore the levels of the SAMR model and learn how to use Nearpod to facilitate greater student engagement through students' active participation in lessons using this medium
- Technology Integrated Collaborative Lesson Planning

Technology –

- Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

APPENDIX I

PLC Meeting Agenda Session 4

Meeting called to order

- Review SAMR Model
- Interactive Technology Professional Development

  Making lessons interactive using the Smartboard – Teachers will learn how to use the smartboard to facilitate greater student engagement through students' active participation in lessons using this technology.
- Technology Integrated Collaborative Lesson Planning

  Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to

Technology –

- identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

Technology –

APPENDIX J

PLC Meeting Agenda Session 5

Meeting called to order

- Review SAMR Model
- Interactive Technology Professional Development

  Teachers teaching teachers and Progress check: Collaborative review of SAMR and the learning platforms learned so far. Digital Resource Coach will work with individual teachers. Teachers will also learned about Actively Learn and Quizlet and how to use these platforms for instructional purposes.
- Technology Integrated Collaborative Lesson Planning

  Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

APPENDIX K

Technology –

PLC Meeting Agenda Session 6

Meeting called to order

- Review SAMR Model
- Interactive Technology Professional Development

SAMR review. Using AnswerGarden for student feedback toward brainstorming and collaboration. Making lessons interactive using Today's Meet and Mentimeter. Teachers will learn how to use AnswerGarden, Today's Meet, and Mentimeter to facilitate greater student engagement through students' active participation in lessons using these media.

- Technology Integrated Collaborative Lesson Planning

Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

APPENDIX L

PLC Meeting Agenda Session 7

Technology –

- Meeting called to order
- Review SAMR Model
- Interactive Technology Professional Development

  TTIS & TPSA Post Survey Administration

  Teachers teaching teachers and Progress check. SAMR review. Revisit the learning platforms learned during technology PD. Teacher one-question self-assessment survey.
- Technology Integrated Collaborative Lesson Planning

  Teachers will work with their colleagues in the same content area to discuss what works and what has not work in terms of implementing the strategies introduced during technology PLC sessions. They will also collaborate to create future technology integrated lessons. Teachers from all content areas will work with the facilitator to identify technology integrated strategies and demonstrate their use regarding content specific application of technology resources.

Technology –

□

Biography

Hannah Karima Hoilett-Frierson was born in 1982 in Kingston, Jamaica.

Earning a full scholarship to play Division I soccer, Hannah completed her undergraduate studies at South Carolina State University in Orangeburg, SC where she majored in English. During her undergraduate tenure, she received several academic and athletic accolades, served as the captain of the women's soccer team, and was named the 2004 poet laureate of the university.

In 2007, Hannah earned a Master of Science from South Carolina State University. In this year she also began teaching English at Orangeburg-Wilkinson High School. During her tenure at Orangeburg-Wilkinson, Hannah has served in several leadership capacities. These include
English department chairperson, technology facilitator, student intervention team leader, High Schools That Works lead teacher, varsity girls' soccer head coach, yearbook adviser, and district instructional leadership team member.

In 2013, while continuing to teach, Hannah earned principal licensure and an Education Specialist degree in Education Leadership and Administration from Walden University. She is currently a member of the Walden University Student Advisory Council.

In 2014, Hannah began her doctoral studies at Johns Hopkins University.